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# ClimaStyle: Online Destination for Fashionable Weather-Driven Attire

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*Abstract:-*The research paper focuses on online clothing shopping and its challenges in the context of technology, climate change, and consumer behavior. The main problem discussed is how online shoppers struggle to find comfortable and weather-appropriate clothing due to unpredictable weather patterns caused by climate change. The main goal of this study is to propose a solution, a website that gives clothing recommendations based on weather and location. This solution aims to make online shopping more satisfying, boost brand reputation, and increase retailer profits. The results show that consumers are interested in weather-based clothing suggestions, leading to higher engagement and revenue for online clothing stores. The user-friendly system can adapt to different retailers and clothing options. However, the success of this solution relies on ongoing improvements and user feedback. Customization options for retailers are also essential. This research offers a practical solution to the challenge of finding weather-appropriate clothing online. The proposed system can enhance the online shopping experience and has the potential to become a competitive advantage in the e-commerce industry as climate-related clothing preferences gain importance.

*Keywords:* online clothing shopping, weather, weather-based clothing recommendations, e - commerce website

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## 1. Introduction

Technology is getting better and better, and now people have lots of smart gadgets that make their daily life easier. One of the things many people like to do with these gadgets is shopping on the internet. Thanks to these modern technologies, anyone can easily buy things from anywhere in the world with just one click. This has changed how people shop, making it much more convenient [1].

Online shopping has become popular, especially for buying clothes. Fashion and clothing are always important, and they can affect the economy of a country because fashion trends change quickly. People are interested in fashion because of the excitement of fashion, and this interest is genuine whether they shop in physical stores or online [2].

To keep customers interested, it is important to make sure the products are of good quality. One key aspect of quality is how comfortable the product is. Even if something looks nice, if it is uncomfortable to wear, people will not be happy with it. Comfort in clothing is not just about the type of fabric used, it is also affected by changes in the weather. That is, when wearing a dress that does not match the weather, the quality of comfort cannot be expected from wearing that dress. Because wearing clothes that suit on a hot day will not provide any comfort to the body on a cold day.

In the world of today, the changes in the climate caused by big issues like climate change are affecting the clothing industry a lot. These climate changes directly affect how comfortable our clothes feel when we wear them, and this has a ripple effect on many different parts of the business world. These climate changes are also influencing what people want to buy, and they have an impact on about 70% of the products and services people choose to buy[3].

The combination of changes in the climate and the clothing industry creates a specific problem [4]. When people shop online, they cannot touch, feel, or fit on the clothes like they can in physical stores. This means people cannot tell how comfortable garments are before buying them. As a result, the clothes people purchase online might not be right for the weather where they live, making them less useful. This causes problems for both shoppers and sellers. Unhappy customers are less likely to buy from a brand again, and this can harm the reputation of the seller.

Solving a problem like this is crucial and relevant in the world of today. Climate change is a serious global issue, as mentioned earlier, and it is affecting various industries, including the clothing sector. Climate change has caused unpredictable weather patterns and extreme temperatures in many regions. These changes directly impact the clothing needs of people and preferences. As climate-related changes affect what people want to buy, consumers are increasingly seeking clothing that can adapt to different weather conditions. This shift in consumer behavior has a significant impact on the fashion industry. It is a problem that affects a wide range of people who rely on online shopping. As mentioned earlier addressing this issue can result in higher customer satisfaction, improved brand reputation, and increased profitability, as unhappy customers can harm the reputation of the brand and the profits of the retailers.

This research has several main objectives. First, it aims to understand how climate change affects what clothes people prefer to buy and the challenges people face when shopping online for weather-appropriate clothing. Secondly, it seeks to create an innovative system that recommends clothing based on the current weather, improving the online shopping experience. Additionally, the study will assess how effective this system is and how it influences what people buy and their opinions of the brands they shop from. The research also investigates ways to make this system even better in the future and will provide practical advice for clothing businesses looking to use this technology. Ultimately, the goal is to help people make better clothing choices in a changing climate while benefiting online retailers and brands.

The proposed solution of creating a website to offer recommendations on clothing choices based on location and weather is an innovative approach to addressing the mentioned problem. It can help consumers make informed decisions and enhance their online shopping experience. The selected research topic is significant because it addresses the intersection of climate change, consumer behavior, e-commerce challenges, and business reputation in the context of the clothing industry. It explores a practical solution to improve the online shopping experience and reduce the negative impacts of climate change on clothing choices.

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The remaining sections of the paper are structured as follows: In Section II, a comprehensive review of the existing body of literature in the research area is presented. Moving on to Section III, the methodology of the study is clearly outlined. The obtained results are deliberated upon in Section IV. Lastly, in Section V, the paper wraps up by succinctly summarizing the main discoveries and proposing potential future research directions in the same domain.

## 2. Literature Review

The literature review examines how technology is changing the way people shop for clothes, both in physical stores and online. It focuses on the idea of virtual dressing rooms, which are smart applications that aim to improve the online clothing shopping experience. The review looks at research papers that discuss the challenges faced by both customers and retailers when it comes to selecting and buying clothes. It also explores different methods and ideas for making shopping more seamless and enjoyable, especially when moving from physical stores to online platforms.

The research paper [2]search into the dynamic nature of the fashion industry and its economic impact worldwide. It presents a comprehensive solution that combines a mobile application and a web platform to address challenges related to clothing selection and purchasing. The mobile app employs personalized 3D models to allow customers to virtually try on clothes, overcoming the issue of physical fitting in online shopping. Additionally, an AI-driven chatbot assists customers in making informed decisions, replicating the in-store sales experience. The web platform caters to retailers, utilizing machine learning to predict fashion sales and improve inventory management. This study demonstrates how technology can effectively bridge the gap between physical and online clothing shopping, addressing fit, guidance, and sales prediction challenges for both customers and retailers.

In a similar vein, the research [1], [2] of A. Masri and M. Al-Jabi introduces the concept of a virtual dressing room that employs the Microsoft Kinect sensor to enhance clothing try-on experiences. By accurately aligning virtual clothes with users' bodies through joint data and utilizing skin color detection, the study aims to revolutionize both in-store and online shopping practices. This real-time superimposition of virtual clothes onto users' bodies through the Kinect sensor showcases a novel approach to clothing selection.

The study of G. A. Cushen and M. S. Nixon[5] introduces a system for smartphones that helps users find clothes similar to what they're interested in from online stores. The system's ability to detect, segment, and quantify clothing features from photos addresses the practical application of clothing recognition, with potential implications for enhancing the shopping experience.

Building on this foundation, S. B. Adikari, N. C. Ganegoda, R. G. N. Meegama, and I. L. Wanniarachchi[6] focuses on implementing an augmented reality virtual dressing room using a single depth sensor, specifically the Kinect V2 sensor. This approach offers an immersive and cost-effective solution to clothing try-on challenges, benefiting both customer interest and purchases.

The literature also underscores the significance of augmented reality platforms for virtual fitting rooms, as explored by I. Pachoulakis[7]. This research emphasizes the role of advanced sensors, 3D clothing simulation, and augmented reality in enhancing the clothing selection process and facilitating interactive try-on experiences for consumers.

Study of S. Priyadharsun, S. Lakshigan, S. S Baheerathan, S. Rajasooriyar, U.U.S.K. Rajapaksha and S.M. BuddikaHarshanath[8]introduces "Fashion Fit," a social network-driven solution that addresses the difficulties consumers face in online shopping, such as staying updated with trends and finding well-fitting clothes. The platform's virtual fitting room, personalized body models, and refined search functionality present a comprehensive solution to enhance the online fashion shopping experience.

In addition, platforms like "LazyLazy" [9] and "Styledon.com" [10] offer innovative features for applying clothing items to real-time customer images and tracking fashion trends, respectively. These platforms contribute to the growing landscape of smart clothing shopping solutions.

The reviewed research papers collectively highlight the growing interest in leveraging technology to overcome challenges in clothing shopping. While each paper takes a distinct approach, they converge on the notion that

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virtual dressing rooms, augmented reality, and AI-driven assistance can revolutionize the clothing selection process. These solutions address challenges related to fit, guidance, and accessibility, offering promising implications for both consumers and retailers. Notably, the utilization of depth sensors like the Kinect and the integration of social networking elements further emphasize the potential for enhanced virtual try-on experiences and improved decision-making in the fashion industry.

## 3. Methodology

TheClimaStyle web application allows consumers to make the clothing selection process more informed. The ClimaStyle web application aims to provide a more comfortable clothing experience to the consumer, focusing on solving a key problem faced by consumers and retailers. The problem is as follows.

When people buy clothes online, they are unable to touch the clothes, as they can in physical stores. As a result, the clothes people buy online may not be suitable for the weather they live in, making them less useful. This creates problems for shopkeepers and sellers. Unsatisfied customers are less likely to make repeat purchases from the same brand, which can damage the reputation of the seller.

A solution has been proposed to address the aforementioned problem. It involves taking inputs such as the location of the users and specific dates (since weather can change from day to day), and then, by determining the weather conditions, presenting clothing suggestions suitable for that weather. The overview of the system that explains this solution in Fig. 1 is shown.
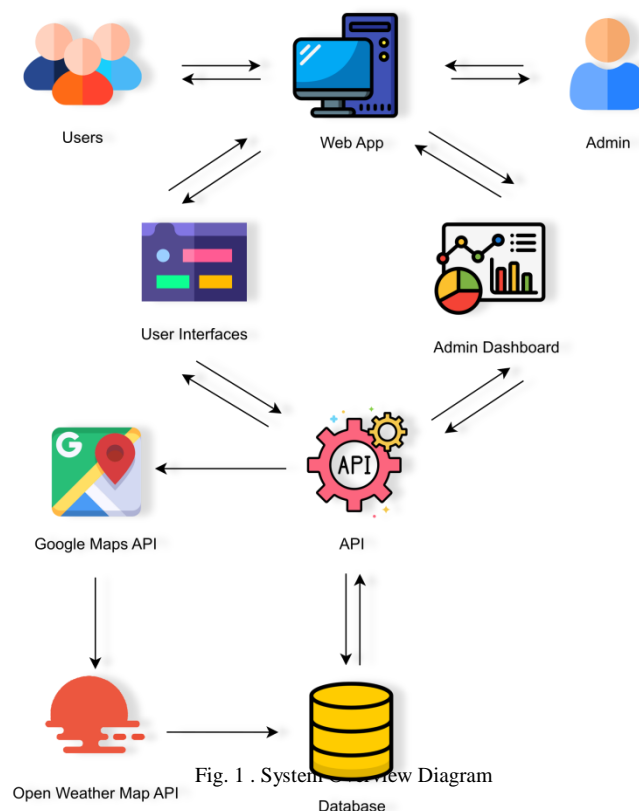


Fig. 1 . System Overview Diagram

To implement the proposed solution, the process is initiated with data collection and processing. The most crucial dataset, namely weather data, was acquired through the Application Programming Interface (API) provided by OpenWeatherMap. OpenWeatherMap is a widely recognized online API that offers weather data and forecasts to individuals, businesses, and developers. It boasts a comprehensive range of worldwide weather-related information, known for its general reliability and accuracy. Consequently, this research leveraged the OpenWeatherMap API to gather weather-related information.

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In the process of obtaining weather data based on locations of the people, the Google Maps service is utilized to retrieve locations of users. Through the Autocomplete feature, customers are empowered to enter any desired location via a search field. The Google Maps service is renownedfor its exceptional reliability and accuracy, which enables users to enter any location worldwide within this developed web application. Fig. 2 shows how the web application allows customers to enter their desired location.



**Fig. 2 . How the web application allows customers to enter their desired location.**

Apart from the location, the next input from customers is the dates. The web application will display clothing suggestions five days ahead of the date the customer requests clothing suggestions. After the customer selects their desired days, clothing suggestions will be based on the weather forecast for those selected days. The customer can choose a few days when they expect the garment to arrive after ordering it online. For instance, if a dress ordered today takes two more days to arrive, the customer will select the days two days ahead from today. Then, clothing suggestions will be provided according to the weather conditions for those chosen dates. The customer can then select the dress that best suits the weather on the day the garment is expected to be delivered. By wearing the clothes received through this process, customers can experience comfort tailored to the local weather conditions. Figure 2 shows how the web application allows customers to enter their desired dates.



**Fig. 3 . How the web application allows customers to enter their desired dates.**

Clothing inventory, another crucial dataset, receives significant attention due to the various fabrics and their suitability for different weather conditions. The test data used for this analysis was sourced from the internet. To ensure accuracy, A set of reasonable values for the proposed solution has been carefully selected. TABLE I below displays the test data used.

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**Table I. Fabrics And Temperrature**

| Fabric Name | Minimum Temperature | Maximum Temperature |
|---|---|---|
| Cotton | 15 | 38 |
| Linen | 21 | 38 |
| Wool | -4 | 15 |
| Fleece | 4 | 15 |
| Polyester | 4 | 21 |
| Nylon | 4 | 21 |
| Down (Insulated) | -18 | 4 |
| Merino Wool | -23 | 15 |
| Polypropylene (Base Layer) | -18 | 10 |
| Silk | 10 | 27 |

The most important and complex task of the presented solution is to provide clothing recommendations suitable for the weather in the respective location. Through carefully selected illustrative data and customer inputs, which include the use of openweathermap and Google Maps APIs, this process has been streamlined to become simple and user-friendly.

The location of the customer is determined using the Google Maps API, which provides latitude and longitude coordinates. The next step involves sending these latitude and longitude coordinates to the OpenWeatherMap API via an HTTP request. OpenWeatherMap accurately identifies the location based on latitude and longitude and provides a weather report for the specified dates.

However, the weather report received from OpenWeatherMap contains a substantial amount of data. It is important to note that the weather report provided by OpenWeatherMap is updated every three hours, representing weather changes occurring throughout the day. To obtain the temperature for a specific day, all temperature values provided by OpenWeatherMap for every three hours of the day should be considered. To achieve this, a mean temperature for a day is calculated considering all temperature values for the day. This approach ensures that researchers obtain a representative temperature value for the selected day. Equation (2) shows how to calculate mean temperature value for a specific day.

$$\text{Mean Temperature of specific day} = \frac{\text{temperature 1} + \text{temperature 2} + \text{temperature 3} + ...}{\text{Total number of temperature values given for a day}}$$

(1)

As mentioned earlier, customers have the option to enter multiple consecutive days through the web application. To present a reliable temperature value suitable for all these days, the mean temperature for each of the selected days is calculated and then the mean of these individual mean values is computed. Equation (2) shows how to calculate the final mean temperature value.

$$\text{Final Mean Temperature} = \frac{\text{Mean temperature of Day 1} + \text{Mean temperature of Day 2} + \text{Mean temperature of Day 3} + ...}{\text{Total number of Days}}$$

(2)

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This final mean temperature value is highly accurate when customers provide several consecutive dates as input. To ensure accuracy, developers should encourage customers to input enough consecutive dates and provide an option to exclude specific dates if needed. Failing to do so may result in an inconsistent temperature value that deviates from the correct value.

Finally, based on this mean temperature value, the system suggests clothing items within the relevant temperature range to the customer. This is how the proposed solution leverages the location of the customer and the climate of that location to provide tailored clothing recommendations.

The ClimaStyle Web application is a versatile platform that not only offers clothing suggestions based on the weather but also encompasses all the features people would expect from a standard online clothing store, including powerful filtering methods. Within this application, customers have the unique opportunity to tailor their clothing choices according to the prevailing weather conditions. Additionally, they can explore the product catalog and select clothing items as they would in any regular online store. The clothing database of the ClimaStyle web application is categorized into various groups, allowing customers to easily filter and locate the garments they desire. To do so, they simply need to access the product list and choose their desired category and type. Clothing categories and types can vary significantly from one store to another. Therefore, for this research, A few categories and types have been chosen to illustrate the ClimaStyle Web application. Used illustrated categories and types [11], [12], [13] are shown below.

*A. Categories*

- Tops
- Bottoms
- Outerwear
- Dresses
- Activewear
- Sleepwear
- Swimwear

*B. Types*

- T-Shirts
- Sweaters
- Frocks
- Jeans
- Trousers
- Shorts
- Skirts
- Pajamas

The ClimaStyle web application includes various functionalities such as a shopping cart, checkout and payment processing, product reviews, and feedback. Its user-friendly interface enhances the user experience for these features. Additionally, the application supports essential functions like product management, order management, inventory management, and user management on the admin side.

One noteworthy feature is that when administrators add products to the database, they specify the colors of the respective clothing items. Due to the vast array of available colors and color combinations, it is impractical to include them all in the web application. Therefore, the development of the web application has focused on incorporating eleven commonly used colors [14], [15], as listed in Fig.  4.

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Fig. 4 . Commonly Used Colors for Clothes in the Web Application

In addressing the challenges associated with creating the ClimaStyle web application, The solutions implemented are outlined. Furthermore, some other common features of the ClimaStyle web application were discussed. For the development and implementation of the ClimaStyle web application, a modern technology stack and several key tools will be employed to ensure efficient development, collaboration, and functionality. The following are the primary technical components of this project.

The application will be built using the MERN stack, comprising MongoDB, Express.js, React.js, and Node.js. MongoDB will serve as the database for storing user data, clothing information, and other relevant data. Express.js will be used for building the backend server, while React.js will power the frontend user interface. Node.js will handle server-side logic. To facilitate collaboration and version control, GitHub will be utilized as the primary platform. This will allow for effective code management, branching, and merging among team members, ensuring seamless development, and tracking of changes. Firebase, a cloud-based platform, will be integrated to handle the secure upload and storage of images, such as clothing items. The real-time database capabilities of Firebase may also be leveraged for certain dynamic features within the application. Visual Studio Code (VS Code) will serve as the primary integrated development environment (IDE) for coding and debugging. These technical tools and technologies have been carefully selected to ensure the development of a robust and responsive web application that addresses the problem of clothing selection based on weather conditions. They provide a solid foundation for implementing the proposed solution and achieving the objectives of the research.

## 4. Results and Discussion

After introducing the weather-related clothing recommendation system to consumers, it is certain that consumers will be more engaged with weather-specific clothing suggestions. Researchers believe that consumers will regularly visit the search page for weather-adapted clothing items. Consequently, it can be concluded that the income of the online clothing store is increasing day by day. More people are visiting the website than in earlier days because the proposed web solution offers a unique experience to customers. Many online shops may require this new solution in the future, as it is easy and cost-effective to develop. Therefore, shop owners can purchase it at an affordable price and provide a fresh experience to their customers. Moreover, this proposed solution features a user-friendly interface, ensuring that individuals of all ages can easily become familiar with the application. Hopefully, the recommendation algorithm will accurately suggest weather-appropriate clothing, and users will find these suggestions valuable, resulting in high satisfaction with their shopping experience. The proposed e-commerce website aims to gain a competitive advantage by providing clothing recommendations based on the weather, as this is expected to influence the choice of online retailers by users.

While the researchers anticipate that the recommendation algorithm will function effectively at the outset, it is recognized that continuous improvements will be necessary to keep up with changing weather patterns and evolving user preferences. Based on the expectations of the researchers, they plan to incorporate user feedback and increase responsiveness to user suggestions after the system is released.

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As shown in TABLE I, a limited yet reasonable range of fabrics and temperature ranges has been selected for illustrative purposes. However, in the dynamic realm of fashion design, new fabrics are constantly introduced. ClimaStyle, the online clothing store, has incorporated a feature that allows for the inclusion of any number of fabrics into its database. This presents a valuable opportunity to compile a fabric list that aligns with the clothing available in the store. The necessary fabrics and their associated temperature ranges can be sourced from clothing suppliers. Upon obtaining this data, the web application operated by ClimaStyle can deliver the most precise suggestions based on the latest information. It is important to note that there are various categories and types of clothing, which may vary from one store to another. Therefore, the data list should be prepared to align with the specific needs of each shop. For illustrative purposes, TABLE 2 displays the categories and types used in the proposed solution. The web application is designed to allow shop owners to easily customize this list to match their offerings of the store. The same flexibility applies to clothing colors as well. In the case of ClimaStyle, the proposed solution was illustrated with a limited number of colors that are shown in Fig. 4, but the shop owners could easily add as many colors as they wanted to the database.

As shown in Fig. 3, customers are allowed to select for several days. OpenWeatherMap provides free weather data for a specific location only up to five days in advance. Initially, the free version of OpenWeatherMap was used to present the proposed solution. However, once the payment is made, they can choose the desired number of days for clothing recommendations. Developers have the flexibility to accommodate this requirement.

As mentioned earlier, if the distribution of clothes is limited to within the same country, delivery can be completed within a few days. However, for cross-border deliveries, it may take a considerably longer time. Therefore, it is essential for the developers to consider all these factors and engage in discussions with the store owner to select a suitable number of days. Subsequently, the web application can retrieve the mean temperature for the selected days and recommend appropriate clothing items, as it did previously. However, it is important to note that if there is a significant temperature difference between the days chosen by customers, the mean temperature provided by the web application may not closely match the temperature of any single selected day. To address this, developers should allow the customer to input a specific and reasonable number of days. This ensures that the recommendations align more closely with the expectations of customers. Neglecting this consideration could lead to decreased customer satisfaction, potentially harming the reputation and revenue of the online store. Furthermore, it may negatively impact the reputation of the developers.

Researchers expect that their weather-based clothing recommendation system will bring significant advantages in engaging users, increasing satisfaction, and boosting sales once implemented. This system is designed to tackle the research challenge of offering weather-appropriate clothing choices to online shoppers, ultimately improving the overall online shopping experience. This research contributes to the expanding field of user-focused e-commerce, highlighting the potential of data-driven recommendations to impact online retail positively.

## 5. Conclusion

In world of today, where technology continually advances, and smart devices are prevalent, online shopping has become a favored and convenient way to acquire goods, particularly in the clothing and fashion industry. The ease with which people can make purchases from anywhere globally with a simple click has accelerated this shift in consumer behavior. However, this transformation comes with challenges, particularly concerning the quality and suitability of products bought online.

This research paper focused on the complex intersection of climate change, consumer behavior, e-commerce challenges, and the reputation of the clothing industry. It aimed to address a specific problem arising from this convergence: the difficulty online shoppers face in assessing the comfort of clothing, especially in various weather conditions. Climate change, a global concern, has led to unpredictable weather patterns and extreme temperatures, directly affecting clothing preferences of the people and needs. Consequently, consumers now seek clothing that can adapt to different weather conditions.

The proposed solution in the form of a website offering weather and location-based clothing recommendations represents an innovative approach to tackle this problem. By providing consumers with informed choices and enhancing their online shopping experience, this solution intends to bridge the gap between the limitations of

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online shopping and the need for weather-appropriate clothing. It holds significant promise for improving customer satisfaction, strengthening brand reputations, and increasing the profitability of retailers.

The results and discussions presented in this paper underscore the potential of this solution. As demonstrated by the increased engagement and revenue of an online clothing store that implemented the proposed system, consumers have shown a strong interest in receiving clothing suggestions tailored to their local weather. The user-friendly interface of the system and adaptability to include new fabrics, categories, and colors make it suitable for a wide range of online retailers.

However, the success of this solution depends on ongoing improvements and adaptation to changing weather patterns and user preferences. User feedback will be crucial to fine-tuning the recommendation algorithm, ensuring its accuracy and relevance over time. Additionally, customization options for clothing categories, colors, and the number of days for weather recommendations will empower retailers to tailor the system to their specific product offerings and customer expectations.

The research contributes to the user-focused e-commerce landscape by offering a practical solution to the challenge of choosing weather-appropriate clothing when shopping online. The proposed weather-based clothing recommendation system has the potential to revolutionize the online shopping experience, providing users with valuable insights and enhancing their satisfaction. It demonstrates how technology can address real-world problems, such as those stemming from climate change, and underscores the importance of data-driven recommendations in the retail sector. As online retailers increasingly recognize the significance of weather-responsive clothing choices, the implementation of such solutions is poised to become a key competitive advantage in the ever-changing world of e-commerce.

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