# The Influence of Smart Wearable Technology on the Functionality and Fashion of Casual Wear

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**Abstract:** The rapid development of smart wearable technology has put forward new requirements for casual wear design. Design is facing comprehensive innovation in multiple dimensions such as functional integration, material innovation, and user experience. Casual wear design is transforming from a single wearing function to "smart wearable", which requires design to consider the integration mode of electronic components and clothing structure. This article analyzes the role played by smart wearable technology and its impact on the clothing industry. It focuses on elaborating the balance between technological concealment and fashionable expression by smart wearable technology, and its influence on promoting the transformation of clothing from "passive wearing" to "active interaction" and achieving the industrial upgrading of "function as the body and fashion as the application". Provide certain theoretical basis for relevant practitioners to carry out their work.

**Keywords:** Smart Wearable technology Casual wear; Functionality; Fashionability

## 1. Preface

Smart wearable devices refer to the intelligent and innovative design of daily wearables by applying wearable technology, developing wearable devices such as various smart bracelets, smart glasses, smart clothing and accessories for vital sign monitoring. Wearable technology is the foundation that supports the operation of smart wearable devices. The concept of wearable technology was first proposed in the 1960s by the Media Lab at the Massachusetts Institute of Technology in the United States, embedding technologies such as sensors, multimedia and wireless communication into clothing to maintain social connections. The year 2016 was regarded as a turning point for wearable technology. Revolutionary materials in the field of smart textiles, such as "computational fibers", embedded sensors and technological innovations in smart textiles, dominated the future of smart wearable technology clothing. Smart wearable technology is applied to casual wear. The advancement of hardware technology has made smart devices lighter and more powerful. Under the balance of technological innovation, aesthetic expression and sustainability, it solves the seamless fashion transformation of casual wear from single function to "technology as fabric". For example, graphene heating technology can quickly heat up to 53℃ in 5 seconds, and PCM technology can achieve bidirectional temperature regulation through microcapsule packaging. It is adaptable to an environment ranging from -5℃ to 35℃. The LIMUNet model analyzes movement postures in real time, fully meeting consumers' demands for health monitoring, environmental adaptation and personalized expression. It also promotes the transformation of clothing from "passive wearing" to "active interaction", achieving an industrial

upgrade of "functionality as the body and fashion as the application".

## 2. It is a trend of The Times that smart wearable devices enhance the functionality and fashion of casual wear

Smart wearable devices have become an important tool for modern people's scientific exercise. The health monitoring function in smart wearable devices has become the most valuable application in casual clothing. The health monitoring garment looks no different from ordinary sportswear. It weeps sensors into the fabric and sets a small display screen on the left chest. Users can view their electrocardiogram data by lowering their heads. Through precise monitoring and data analysis, it can help users optimize their exercise plans and significantly improve physical comfort, achieving a seamless integration of medical-grade functions and daily wear. Transforming casual wear from merely a tool for appearance expression into a comprehensive health management platform, technological breakthroughs have made functionality take into account comfort as the main focus. Smart devices have achieved a "seamless wearing" experience while maintaining fashion trends, confirming the adaptive evolution of balanced design between functionality and aesthetics in the field of smart clothing.

### 2.1. The weight distribution should be comfortable, and the exercise plan for smart wearable devices needs to be optimized

The smart T-shirt features built-in sensors that can monitor the user's physiological parameters such as heart rate, breathing, and sweat volume in real time. The sensors transmit the data to the mobile phone APP for display and analysis, helping users better understand their own physical conditions and providing assistance in formulating better exercise plans and living habits. However, the built-in sensors in the clothing will cause compression to the original space of the clothing. The sensor itself has a certain weight and will occupy a certain space. Due to its relatively hard texture, it needs to be perfectly hidden. At the same time, many issues such as counterweight and comfort also need to be considered. If the design is unreasonable, users may experience a distinct foreign body sensation when wearing clothes. Even the sensor may come into direct contact with the skin. Prolonged friction not only damages the sensor but may also chafe the user's skin, providing an unsatisfactory wearing experience. Meanwhile, the issue of counterweight is also a key point that needs to be considered in innovative design. Because the sensor itself has a certain weight, if it is placed randomly in a certain area, it may cause counterweight problems. The placement of sensors will also have an impact on fashion. How to perfectly hide sensors is an important issue that needs to be considered in the design. Choosing to wrap the sensor in the fabric, although it can hide the sensor, may affect comfort. There are also options to integrate sensors with accessories, making them part of the "fashion" of clothing. However, this approach may result in the sensors coming into more contact with various items, increasing the risk of damage [1], and users may experience obvious abnormal sensations when wearing the clothing. For instance, some designers place sensors on the lower right side of the clothing. When wearing the clothing, users will feel a more obvious pulling sensation on the left side, and this feeling is particularly noticeable during exercise. This also affects comfort.

### 2.2. Aesthetic Diversification: Smart wearable devices need to meet the fashion demands of different users

At the design stage, smart wearable devices need to take into account factors such as users' age and gender to create multiple products to meet the diverse needs of different user groups. The personalized customization function is often limited by intelligent technology. Since customization is usually limited to color changes, users can match the colors of the clothing by themselves, but they cannot change the layout of various contents of the clothing. Take a certain sports brand as an example. The brand's sneakers are equipped with chips that can monitor in real time the athlete's running distance, number of passes, number of sprints and other data. These sneakers can be customized on the brand's official website,

but the customization content is limited to color DIY. Users cannot adjust the position of the LOGO or the chip. The main reason is that the brand needs to consider the cost issue. If the customized content is adjusted at will and requires the use of brand-new molds for production, it will lead to a significant increase in costs. At the same time, randomly adjusting the position of the chip may cause many problems and even lead to chip damage. This is also one of the important reasons why it is difficult to achieve personalized customization.

To understand the user's needs as much as possible, the design can be slightly modified on the basis of the original design and more styles can be launched to meet the fashion aesthetic demands of different users[2]. Smart wearable devices can achieve light personalized customization. Firstly, they adopt a modular architecture design, and use standardized interface electronic components and magnetic connection schemes, which are convenient for disassembly and cleaning. Second, it caters to humanized demands. The conductive yarn realizes washable circuits, the bionic nanomaterial sensor conforms to the human body curve, and the 3D direct knitting technology avoids traditional cutting and sewing.

## 2.3. Tactile Fashion Revolution: Smart wearable devices need to integrate technological aesthetics

Smart wearable devices have evolved from merely functional products to lifestyle carriers that integrate technology and fashion. Especially among young people, there is a certain pursuit of fashion from functional orientation to sensory experience. The requirements for wearable devices in terms of design concepts, material applications, and experiences have been upgraded from "usable" to "both smart and fashionable". Fashion is developing rapidly. Smart wearable casual clothing incorporates a large number of fashion elements and is difficult to integrate with technological elements. When users wear these clothes and attach smart devices, there will be a relatively obvious mismatch, and even the problem of being incongruous may occur, which will have a serious impact on product sales[3]. Due to the slow reception speed of users, it may lead to users being completely unable to understand the content, resulting in a decline in their desire to purchase. Therefore, design should not overly pursue fashion, causing clothing to be completely disconnected from the market. The development of smart wearable devices has given rise to brand-new technological aesthetic design concepts and material applications. The emergence of various new materials has further enhanced the beauty and comfort of smart wearable devices, bringing more possibilities to clothing design[4].

## 3. Smart wearable technology strikes a balance between technological concealment and fashionable expression

According to the latest report from IDC International Data Corporation, the global share of smart clothing has jumped from 3% in 2020 to 27% in 2025, showing an explosive growth trend. Casual wear, as a major category of daily wear, has become an important carrier for the application of smart wearable technology. The reasons for this are as follows: Firstly, the innovation of technological materials has made intelligent functions an inherent attribute of fabrics, changing people's lifestyles and providing greater convenience and freedom for movement and leisure. Second, it is the high-level unity of technology and aesthetics, capable of balancing the relationship between concealed technology and fashionable expression. Concealed technology requires that technical components be invisible and imperceptible, without affecting the comfort and daily functional use of the clothing. Fashion expression emphasizes the visual aesthetics, individual display and trend culture of the clothing.

## 3.1. The technology is concealed and meets the functional requirements of users' health management

Technology concealment, also known as sensory invisibility, as a modern design concept, advocates that technological products should blend into the environment without drawing attention. It is a delicate balance of the integration of technological elements and human perception. The covert formation of technology has gone through the process from the 18th century when British philosopher Anthony Ashley-Cooper proposed "inner senses", to the late 20th century when Japanese designer Naoto Fukasawa proposed "unconscious design", advocating the transformation of unconscious actions

into visible things. Then, with the rise of wearable devices in the early 21st century, concealed technology was clearly defined as the development stage of electronic systems where smart devices are not noticeable in terms of vision, touch, and social acceptance. The main application directions of technological concealment in smart clothing gradually include health monitoring, environmental interaction, and energy management. The key technologies include the material level of flexible electronic fibers and bio-based circuits, the modular structure design level of, and the multi-modal human-computer interaction level of. Sensory invisibility is driving the transformation of smart clothing from functional addition to experience integration, with the goal of achieving a perfect balance between technology imperceptionality and clothing intelligence.

Applying "subtractive design" to reduce obstacles in the use of technology is the main technical path to achieving covert technology. This type of design understands the technical cognition and aesthetic preferences of different groups of people. The device provides targeted services to users based on their living and exercise habits, achieving a truly people-oriented intelligent fashion solution. For the general public, smartwatches can be equipped with infrared light wave and multi-channel optical sensor devices, which can monitor data such as heart rate and blood oxygen in real time. Some of the devices have a high level of precision and can even pass the FDA medical certification with "medical-grade precision". Some devices also incorporate AI technology. By using large AI models to analyze the wearer's heart rate, breathing, blood oxygen and other data, potential diseases can be prevented in advance. For the elderly or patients with diseases, the mode can also be adjusted specifically, the key monitoring data can be changed, and the risk of sudden onset of the disease can be reduced. If a user has hypertension, the device will assess the user's living conditions and medication usage based on the changes in their blood pressure, and provide functions such as medication reminders, transforming passive recording into active intervention to ensure the user's life safety. By analyzing these data, users can also assess their own physical condition and promptly change their training methods to achieve better training results.

## 3.2. Wearable devices actively adapt to the environment, achieving a balance between technology and fashion

The environmental adaptation function is the second major breakthrough direction for smart casual clothing. The "light energy temperature-controlled fiber" has almost no technical components. It can convert 30% of solar energy into heat energy, enhancing the warmth retention rate while reducing the weight of winter casual wear jackets by 40%. Therefore, casual wear has transformed from passive protection to active adaptation to environmental changes, which has become the core direction of the innovative development of intelligent systems.

When the human body is in motion, the heart rate, breathing rate and blood flow rate all increase. To better monitor the physical data during exercise and provide support for targeted training plans, smart wearable devices will promptly record the user's exercise volume, calculate calorie consumption, assess recovery time and offer assistance in conducting scientific training. Therefore, intelligent clothing design has shifted from static aesthetics to dynamic interaction. The core components of wearables inject emotional interaction experiences into the digital fashion field, blurring the boundaries between technology and art, and proactively becoming a dynamic medium connecting smart wearers with their surrounding environment. For instance, smart glasses have significant differences from traditional glasses. Traditional glasses rely on the mirror surface to correct vision, while smart glasses are equipped with miniature cameras, and the mirror surface acts like a player. It uses AI technology to process originally blurry images, allowing users to have a clear field of vision. For different usage scenarios, smart glasses can also switch between different modes, making the technological performance visible but forming a personalized expression. Fashion bloggers commented, "Perfectly matched with casual outfits, the technological sense is not jarring." . In foggy weather, the use of AI intelligent algorithms can to a certain extent eliminate the impact of fog on vision, thereby effectively enhancing safety. For visually impaired people, smart wearable device manufacturers have developed smart AI glasses to solve users' vision problems through AI. Some smart wearable devices can also be connected to mobile phones and electrical appliances to achieve voice remote control. The technological elements appear and disappear as the body moves, adding interactive fun. For instance, users

can control the air conditioners, lights and other devices at home through voice commands on their smartwatches. The seamless interaction as the entry point of the "human-home" full ecosystem has brought great convenience to residents' lives. In addition, smart wearable devices can monitor users' sleep quality, provide personalized sleep plans for them, help them improve their sleep conditions, and extend functions without increasing the burden on hardware, thus better maintaining physical and mental health [5].

## 3.3. Personalization further enhances users' acceptance of smart clothing

Clothing is not only a "tool", but also a kind of fashion "accessory". With the continuous improvement of people's pursuit of beauty and fashion, the rich variety of colors, textures and shapes of casual wear has met the aesthetic needs of different users, providing diverse choices for users of all ages. When designing smart casual wear, one should not limit the focus to "smart wearable technology". Instead, multiple perspectives should be adopted, taking into account various factors such as age, device, and gender, to enhance users' acceptance of fashionable clothing. Light personalized customization, a new service model between haute couture and ordinary ready-to-wear. Compared with deep customization, it does not involve changing the existing structure and function of the product. Instead, it achieves limited personalized expression through surface treatment or limited module replacement. For instance, it allows users to lightly "ID" their clothes through the network. Users can freely match the colors of the clothes and change the position of the LOGO, etc. This kind of light customization enables more users to showcase their individuality. Further enhancing users' acceptance of clothing[6], demonstrates unique application value in the field of smart wearable clothing.

Smart wearable devices offer users an intelligent and personalized clothing experience. For instance, smartwatches can monitor users' various physical and sports data, while smart glasses can provide users with a more realistic and clear visual experience. When these devices are designed, not only functionality but also fashion are taken into account. These devices are all quite aesthetically pleasing. It is very much in line with the aesthetic standards of young people in today's era. Smart wearable devices build an intelligent clothing ecosystem. By connecting smart wearable devices to the Internet, clothing enterprises can provide users with a large number of personalized and value-added services. For instance, smart running shoes can automatically adjust their softness and hardness based on the weather and ground conditions, providing users with a comfortable exercise experience.

## 3.4. Ensure a comfortable experience to enhance the fashionability of smart wearable clothing

The introduction of smart wearable devices will have an impact on the comfort of clothing. Comfort is a factor that must be taken into account in design. As clothing needs to be in prolonged contact with the human body, how to reduce the foreign body sensation and enhance comfort is an important issue faced in design. With the development of materials science, a large number of new, lightweight and breathable materials have emerged. These materials are soft and resilient in texture, and do not irritate the skin, bringing many advantages to clothing design. By applying a large amount of brand-new materials, it is possible to design clothes that meet both fashion and functionality requirements while ensuring comfort. The "photoelectric interactive fabric" endows the fabric itself with intelligent functions, fundamentally solving the problem of hardware squeezing design space. It is called a wireless, chip-free, battery-free invisible electronic skin. This technology is manifested in practical applications as embedded chips in biaxially oriented fabrics. For instance, Athos sportswear achieves a perfect balance between comfort and functionality.

While considering comfort design, ergonomics should also be taken into account. For instance, when designing pockets for clothes, it is necessary to ensure their ease of use and comfort; otherwise, the pockets may become mere "decorations", which could instead affect the functionality of the clothes[7]. Young people in today's era carry all kinds of electronic devices when they go out, such as smart phones, Bluetooth headphones, smartwatches, etc. When not in use, these devices are usually stored in their clothes pockets or trouser pockets. Therefore, when designing pockets, two methods, namely "invisible" and "visible", are adopted according to different design concepts. "Invisibility" refers to the situation where the pockets of clothes and trousers are hidden, making the garment appear more integrated. Without careful observation, it is difficult to notice the existence of the pockets of clothes. "Visible" refers to the fact that the pockets of clothes are very conspicuous and even serve

as part of the clothing decoration, further enhancing the beauty and fashion of the clothes through the pockets. No matter what concept is adopted, its comfort and functionality should be guaranteed as much as possible. Functionality should not be overly sacrificed for the sake of aesthetics, otherwise it may have an impact on sales [8].

# 4. Conclusion

With the continuous expansion of the smart wearable device market, people are increasingly fond of tactile fashion. Human-computer interaction technology transforms cold technology into warm emotional experiences. Smart wearable technology enables casual wear to transcend its functional tool attributes and become a "second skin" that integrates tactile interaction, emotional expression and fashion aesthetics. The essence of technological aesthetics is to achieve a dialectical unity of the functional rationality and visual perception of smart wearable devices.

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