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Retraction

Retracted: Internet+ and Smart Wearable Devices for Three-Dimensional Monitoring of Tennis Physical Exercise

Mobile Information Systems

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] Z. Li and F. Li, "Internet+ and Smart Wearable Devices for Three-Dimensional Monitoring of Tennis Physical Exercise," *Mobile Information Systems*, vol. 2022, Article ID 6933510, 13 pages, 2022.

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Research Article

Internet+ and Smart Wearable Devices for Three-Dimensional Monitoring of Tennis Physical Exercise

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"Internet+" is developing rapidly, and smart wearable technology has gradually advanced, with the support of two major technologies. This paper realizes the conception of three-dimensional monitoring of tennis physical exercise based on two major technologies. This paper firstly organizes and analyzes the research results of scholars on Internet+, smart wearable devices, tennis physical exercise, and three-dimensional monitoring concepts. It summarizes the experience and realizes the construction of this research system. Then, the meaning and characteristics of Internet+, the definition, classification, and future development of smart wearable devices are outlined. In addition, the structure of the three-dimensional monitoring system is expounded, and then, the feasibility of this research is proved by examples and data. Finally, the problems encountered in this research process are discussed, and the experimental process of three-dimensional monitoring is summarized. The survey shows that 216 people in the city feel very comfortable with the bracelet experience, and 393 people have a good experience overall, reaching more than 93% of the surveyed number.

1. Introduction

With the improvement in people's living standards and the increasing pressure of work, people gradually began to worry about their own health. However, the fast pace of life makes people have less and less time at their disposal. Therefore, people urgently need medical instruments that can be miniaturized, humanized, networked, and also intelligent. Therefore, in the face of this strong demand, smart wearable medical devices have come out. The earliest wearable medical devices were relatively bulky and basically required the tester to maintain a certain posture and sit in a fixed position. And the types of data measured are relatively small, basically body temperature, heartbeat, etc. After a period of development, wearable medical devices have improved. It is more comfortable to wear, and the types of data measured are correspondingly more. However, it still lacks certain intelligence and humanization, and it is basically a stand-alone operation state. Some modern smart wearable medical devices are relatively advanced and basically have the characteristics of miniaturization, humanization, intelligence, and networking. But there is still a long way to go from idealization, and it still needs to continue to improve.

The development of technology is always beyond people's imagination. In the early days of agricultural society, people used barter as their business support. Entering the industrial age, currency exchange was used as a form of business. In the Internet age, the business has opened up new operating models through the Internet and developed rapidly. In today's information society, the functional integration of smartphones and the matching of software systems have changed our previous business models. Products are no longer a single consumer product but are more autonomously integrated into people's lifestyles. At present, theoretical research on smart wearable devices focuses more on the discussion of technology and scalable business areas. How to study the design of smart wearable devices from the perspective of design, especially from the perspective of users, still needs to be gradually deepened.

The innovation of this research is that it fully combines the advantages of "Internet+" and smart wearable technology to realize the three-dimensional monitoring of the tennis exercise process, although this is only a concept. However, it provides a good reference discovery for the development of Internet+. At the same time, this three-dimensional monitoring concept involves more than just tennis exercises. Therefore, it provides a framework for future research. Finally, the monitoring algorithm used in this study is specially tested, which proves the effectiveness of the algorithm. "Internet+" and smart wearable physical exercise three-dimensional monitoring system adopts the research idea of "Internet+" new thinking. It can scientifically and accurately observe the real-time changes in multiple physiological parameters during physical exercise. Relying on the multiphysiological parameter measurement technology of smart wearables, on the basis of mature technology, there are many measurement indicators. It can provide an early warning mechanism for scientific and informatization of physical exercise and for subhealthy people. This provides a favorable guarantee for the vigorous development of the national fitness industry and also provides a training base for students majoring in social sports guidance and improves their professional skills. It is of great significance to realize the effective monitoring and guidance of sports services.

2. Related Work

Based on the research on the concept of Internet+, smart wearable devices, tennis physical exercise, and three-dimensional monitoring, many at home and abroad have provided a lot of references.

Chen et al. explored the correlation between power Doppler and three-dimensional (3D-PD) and microvascular morphometry of endometrial vascularity. Studies have shown that endometrial vascularity assessed by 3D-PD cannot be used to reflect changes in endometrial microvasculature during embryo implantation in women with unexplained recurrent miscarriage [1].

Joseph et al. compared finite-element method (FEM) models and capacitance models to model partial discharges in insulation. He also tried to determine reliable parameters for monitoring the condition of cable insulation. A three-dimensional cable model based on the finite-element method was developed in ANSYS software. These include the effects of surface charge accumulation and propagation and the phenomenon of charge decay at void surfaces. Given the simplicity and appropriateness of the capacitance model in estimating model parameters from actual cable measurements, analysis of the simulation results suggested the relevance of the capacitance model, which can be used for cable insulation condition assessment [2].

Camperi et al. describe for the first time the development and use of an online three-dimensional high-performance liquid chromatography/mass spectrometry (3D-HPLC/MS) method. It is used to monitor glycosylation patterns at mid-to-upper levels. To compare the performance of this analysis strategy with traditional offline procedures, a proof-of-concept study using two mAbs is described here [3].

Moldoveanu et al. introduce the concept of 3D sensor arrays specifically for autonomous marine vehicle applications for seismic acquisition. Moldoveanu et al. presented the results of some field experiments and simulation studies to demonstrate the potential of this novel seismic acquisition technique [4].

Zoupanou et al. propose an experimental application that combines computer-aided design (CAD), micromilling techniques, and manipulating fluids and nanoparticles. This is a method for fabricating three-dimensional (3D) polymethyl methacrylate (PMMA) fluid mixers [5].

Giannakou et al. demonstrate the fabrication of supercapacitor 3D objects by inkjet and water transfer printing.

In addition, he further explored the concept of water transfer by transferring supercapacitors onto human skin for epidermal energy storage, with a particular focus on smart wearable applications. This novel conformal electrochemical energy storage provides a new alternative for monolithic integration/objects. Such energy storage systems are crucial for complex-shaped devices for IoT and flexible/skin electronics applications [6].

The data from these studies are not comprehensive, and the results of the studies are open to question. Therefore, it cannot be recognized by the public, and thus cannot be popularized and applied [7].

3. Internet+ and Smart Wearable and Three-Dimensional Monitoring System

3.1. Internet+. The so-called "Internet+" refers to the action and process of the diffusion, application, and deep integration of information technology (including mobile Internet, Internet of Things, cloud computing, big data, and other technologies) centered on the Internet in various fields, industries, and sectors of the national economy. It refers to the combination of Internet and traditional industries based on Internet information technology. It completes the economic transformation and upgrading of traditional industries by means of "optimizing production factors, updating business systems, and reconstructing business models."

Under the joint promotion of the continuous evolution of the Internet and the active innovation of the knowledge-based society, "Internet+" came into being. "Internet+" refers to "Internet+ various traditional industries." But it would be wrong to interpret it as simply adding the two together. One must deeply analyze the concept of "Internet+." The working principle of "Internet+" is to stimulate new economic growth points and the vitality of the whole society's real economy. It brings new opportunities for economic reform, industrial innovation, and enterprise development [8, 9].

"Internet+" is the product of the integration of Internet thinking and specific industrial practice. It gives full play to the advantages of the Internet in the process of integration. It can drive the innovation vitality and development opportunities of related economic entities, and provide high-level development opportunities for the upgrading and transformation of related industries. "Internet+" is inseparable from big data. When we talk about "Internet+," we are inseparable from the presence of big data [10]. Specifically, the foundation of "Internet+" is big data, which is the strong support of "Internet+" and the DNA of "Internet+." Without big data, "Internet+" cannot be realized, but with big data, "Internet+" can "play its fists and feet." Big data is an evolutionary device that promotes the evolution of the Internet [11, 12].

The essential difference between "Internet+" and the Internet lies in "+." From the traditional industrial age to the Internet age, the only thing that has changed is the use of the Internet as a tool for traditional enterprises. This reflects the "tool view" of technology [13]. "Internet+" presents a new system and a new structure. It is not just a simple addition, but a new form that breaks the internal structure and way of thinking. The essence of "Internet+" is fragmentation and reconstruction, which reflects the "ecological view" of technology [14, 15].

Internet+ is a further practical achievement of Internet thinking. It promotes the continuous evolution of the economic form, thereby driving the vitality of social and economic entities. This provides a broad network platform for reform, innovation, and development.

The characteristics of "Internet+" are as follows.

3.1.1. Fusion. The most fundamental of "Internet+" is "+." It represents the integration of different fields and different disciplines [16]. The three-dimensional monitoring of tennis physical exercise studied in this article is to study the development demands of three-dimensional monitoring of tennis physical exercise under the background of "Internet+" and smart wearable devices.

3.1.2. Innovation. The "+" in "Internet+" is not a simple addition of technologies and techniques, rather it drives innovation and thinking innovation. This makes everyone a maker and everyone can innovate [17, 18].

3.1.3. Remodeling. Remodeling is an important feature of "Internet+." For example, the essence of studying the ecological environment of smart learning is to reconstruct the learning environment. It is necessary to use modern technological means to reconstruct the traditional learning environment. It injects ecological viewpoints and innovative educational concepts, in order to continuously improve the wisdom of learners and promote the sustainable development of education [19].

3.1.4. Humanity. "Internet+" pays more attention to individual experience. It respects the characteristics of human nature and meets the different needs of learners in the learning process. It can remove the disadvantages of traditional network resources such as flooding, single interaction, and network insecurity [20, 21].

3.1.5. Ecology. Another feature of "Internet+" is ecology, and ecology itself is open, which coincides with the characteristics of the Internet. Sharing economy, resource sharing, transferability of knowledge, etc., all reflect the ecological characteristics of "Internet+." It integrates single, separate things, opens up information silos, connects independent innovations, and creates greater social value.

The most widespread applications of "Internet+" today are mainly concentrated in industry, finance, smart cities, transportation, people's livelihood, medical care, education, agriculture, and other fields with practical applications.

3.2. Smart Wearable Devices. Smart wearable devices integrate RFID radio-frequency identification, GPS, sensors, VR (virtual reality), AR (augmented reality), and other technologies to achieve real-time interaction with people and the environment. Relevant data and information are collected, processed, and shared through big data and Internet cloud platforms [22]. A smart wearable sign device is a portable smart device that is directly worn on the body. It is based on hardware support, data interaction, software, and algorithm implementation to complete various functions of monitoring human body signs. Since the product needs to be in contact with the human body for a long time, its functional stability has become a key requirement [23, 24].

According to the function or product shape, it is divided into watches, bracelets, rings, and glasses, etc., as shown in Figure 1 [25].

It is divided into categories by function: sports and fitness, health monitoring, leisure and entertainment, remote control and information, and so on.

A smart wearable device is a portable device that is directly worn on the body or used as an accessory for users to carry around. It is not just a hardware device. Through the support of various software applications and data delivery, more powerful functions can be realized. Today's smart wearable devices vary according to the parts of the body they are worn on. It can be divided into watches, bracelets, glasses and helmets, and clothing, including the following.

Watches: watches are mostly used as an extension of the screen of mobile devices. Most of them have information push, check time, and some simple applications to help daily life. More complicated watches also have a GPS function to complete various tasks of the bracelet. The amount of data on such a device is related to the application in the watch, and it is likely that it will take a long time to connect to the phone.

Bracelets: most smart wearable devices are related to health and sports. Such as calculating exercise time, exercise posture, exercise volume, and other functions. The data volume of such devices is relatively small, and data transmission is generally performed only after the exercise is over. The specific advantages are shown in Table 1.

Glasses and helmets: Most of them are associated with photography and videography. It is generally used by sports enthusiasts and people who like to record life. Such devices generate large amounts of data. Once real-time transmission

Figure 1: Product example diagram.

Table 1: Smart bracelet and ordinary pedometer difference.

Parameters	Smart bracelet	Ordinary pedometer
Material	Medical nontoxic, rubber	ABS
Sensors	Three-dimensional forces	Two-dimensional forces
Sleep monitoring	Yes	No
Data transfer	Low-power Bluetooth 4.0	USB
Waterproof	Life waterproof 100m	No
Fatigue alert	Yes	No
Lithium battery	Rechargeable	Nonrechargeable

is required, the device will be required to have extremely high data transmission capabilities.

Apparel: most of these devices are Greek devices. The function is relatively simple, and more gestures such as lighting and swinging left and right are controlled through the mobile phone. Such devices only accept data and rarely transmit data.

In order to meet the needs of wireless connection of smart wearable devices, various transmission methods including NFC, BLE, or other new mesh network protocols are currently being used or researched.

NFC: also known as near-field communication technology, it is evolved from the integration of RFID (i.e., noncontact radio-frequency identification technology) into interconnection technology. Security and low-power communication are its hallmarks. But its biggest problem is that the transmission distance is too close, and data can only be exported when the device is offline (such as when charging).

BLE is short for Bluetooth. BLE has a wide-frequency hopping range, fast speed, and shorter data packets than other wireless transmissions. This makes BLE more stable than other wireless transmission systems. The parameter table of the two transmission modes is shown in Table 2.

Table 2: Parameter table for NFC and BLE.

	NFC	BLE
Transmission distance	10 cm	>100m
Transmission speed	424 Kbps	1 Mbps
Version	—	More than 4.0
Whether to match	Nonessential	Need

The technologies involved in smart wearable devices include human-computer interaction technology, sensor technology, embedded technology, identification technology, connection technology, and so on.

From the current development trend, wireless communication technologies such as Wi-Fi, Bluetooth, and NFC are the current mainstream development trends. The simultaneous application of multiple communication technologies has become a trend. This wireless combination chip has many functions due to its small size. This field of wireless transmission is shining brightly. It is a smart wearable device using this combination chip solution. On the premise of high function and high integration, it can greatly reduce its power consumption and meet the increasing functional requirements.

At present, the connection methods of smart wearable devices mostly adopt the connection methods of Bluetooth and WIFI. Therefore, the research on the data transmission process is also mainly focused on Bluetooth and WIFI.

However, since the Bluetooth devices are mostly in the standby state, they are ultimately more power-efficient in practical applications. Smart wearable devices have high requirements for power consumption, so it is more appropriate to use Bluetooth 4.0.

In terms of WIFI, due to its fast speed but high standby power consumption, WIFI is mainly used in the transmission of large amounts of high-speed data. In terms of WIFI version selection, because the smart wearable device needs to be connected with the mobile phone, the WIFI version of the mobile phone limits the choice of smart wearable devices. Most mobile phones currently support 802.11 a/b/g/n versions.

The smart wearable monitoring mode is through the microcontroller on the tester. On the basis of Bluetooth media, the local storage data is imported into the personal computer, and the data are uploaded to the network server, relying on the Internet+ network service platform. It uses data analysis tools and methods to process the collected data and make scientific judgments by experts and scholars in related medical fields. It realizes real-time monitoring of subhealthy people and physical exercisers. The schematic diagram of the structure of the smart wearable monitoring mode is shown in Figure 2.

The interaction between the user and the smart wearable device mainly includes the interaction between the user and the device hardware and the software interaction between the software interface for realizing functions and services:

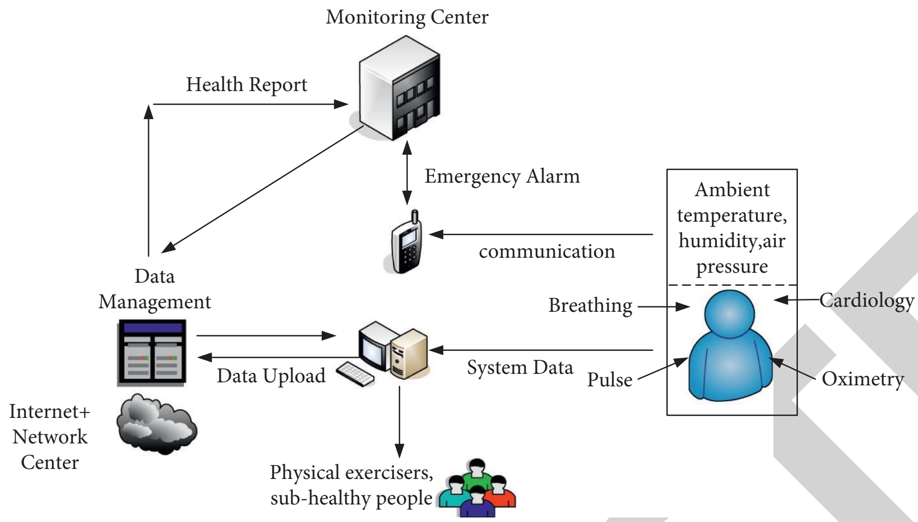


Figure 2: Schematic diagram of the structure of the wearable monitoring mode.

(1) The main interaction methods with hardware devices include bone conduction, eye tracking, microprojection, somatosensory interaction, touch, voice, physical buttons, vibration, and flashing lights.

(2) Software interaction is also presented in several different interaction modes according to the different types of functions. From the experience level, software interaction design should follow the principle of simplifying cognitive load and operational load. It allows users to make mistakes, and the interaction interface and the use situation are integrated with each other. In the actual use of the product, the interaction mode of the smart wearable product can be multimodal to help improve interaction efficiency.

The interaction design principles of smart wearable devices are embodied in the following four aspects:

(1) The new interactive form spawned by the uniqueness of smart wearable devices must first meet the randomness of user needs, and smart devices must be on standby at all times

(2) It can efficiently realize intelligent calculation and accurate analysis of information

(3) Smart devices should be able to accurately sense the surrounding environment and filter out useful information, so that users can make decisions as quickly as possible

(4) In the process of using the device, it allows users to have a good interactive experience that is closer to natural habits

The development of smart wearable devices mainly includes the following three stages:

(1) The initial stage of the form (1970s–1980s): with the release of the world's first wristwatch with a calculator embedded in it and the appearance of a backpack computer, it was a popular trend at that time.

(2) Development stage (1980s–1990s): during this period, the first digital hearing aids appeared. Although it did not develop in the end, this idea is quite informative. Plus, the man known as the first "cyborg" has been relying on wearable computers to improve his eyesight. Also connected to a computer and network, equipped with a display, this device can actually be said to be a prototype of Google Glass.

(3) The vigorous development stage (the end of the 20th century to the present): since the end of the 21st century, in this era of informatization, wearable devices have ushered in its vigorous development stage. Many well-known companies in the IT industry have successively developed many wearable device products.

An example of a smart wearable application is shown in Figure 3.

Smart wearable devices are mainly used in four fields. It includes health and safety, medical and healthcare, industrial and military, and infotainment. At present, the application of smart wear is mainly concentrated in the fields of life entertainment and human safety and health:

(1) In the field of infotainment, smart wearable devices mainly meet people's needs in information exchange and entertainment. Its market space is mainly aimed at young groups who are more receptive to new things. For example, the most representative is the Apple Watch launched by Apple. While it has the same functions as smartphones, it allows users to have a better experience in both visual interface and human-computer interaction. When it covers the watch display with the palm or the arm hangs down naturally, the screen turns off. Users can control the screen display in this very natural way, and also avoid information leakage caused by accidents.

(2) Smart wearable devices are also widely used in the field of health and safety. Smart watches and smart

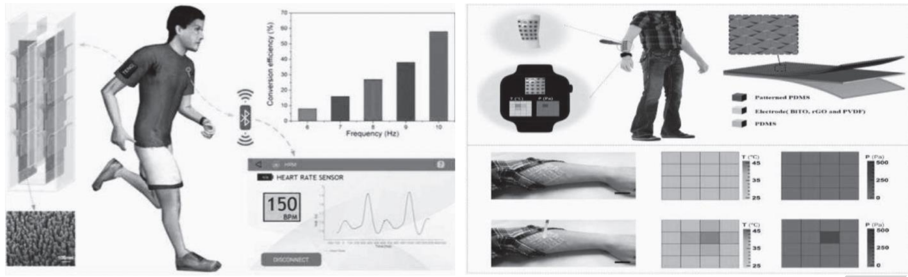


Figure 3: Wearable application demonstration.

bracelets have health trackers, biosensors, and early warning devices. It can monitor and record the distance traveled by the human body, calories burned during exercise, and sleep status in real time, and also upload the recorded information to the data platform in time. It provides users with corresponding reference information and reasonable suggestions through analysis and calculation. The traditional medical model has undergone a transition from hospital treatment to the combination of hospital and individual user-assisted treatment. Based on the development of Internet technology and wearable medical products, "smart medical care" came into being.

Compared with traditional mobile terminals, the biggest difference between smart wearable devices is in the shape, size, and usage of the product. More consideration needs to be given to the interaction between human and machine and the physical characteristics of the product itself.

Due to its particularity, smart wearable devices must be able to transmit information anytime and anywhere, monitor and analyze data accurately, and achieve efficient interaction through the network. The realization of these functions must rely on key technologies such as sensor technology, low-power wireless communication technology, scalable operating system, battery life technology, human-computer interaction technology, and big data.

The development of new battery technologies can help increase the battery life of devices. The application of flexible materials, including flexible batteries and flexible display technology, will also enable smart wearables to better adapt to the curves of human body parts and improve the wearing experience.

Due to its wearable characteristics, the use experience of smart wearable devices is bound to be different from traditional smart terminals. It is limited by the smart wearable device itself, such as the unfamiliar feeling and the inconvenience of the input method when the user wears it. And the diversity and complexity of interaction paths appear according to different types and wearing functions. These are the urgent problems that need to be overcome in the development and design of smart wearable devices. It is also a higher requirement for the human-computer interaction mode of smart wearable devices.

With the development of the future mobile Internet and the emergence of new interactive technologies, smart wearable devices will evolve in stages according to the following trends:

(1) In the future, the development of smart wearable devices will rely on the data information accumulated on the characteristics of human life and posture at the current stage. It converts the original information data into exclusive services that are really used by users.

(2) Smart wearable devices will be integrated with smart homes and smart cities. It realizes the efficient operation of information collection, analysis, and output, and becomes the center of network connection in the new era. For example, by detecting the living habits of users at home, it can launch smart home services that conform to the habits and preferences of users. With the help of smart wearable devices, users can be connected to the smart home.

(3) In the third stage of the development of smart wearables, the subject of its exploration will focus on the expansion of human sensory functions and break the physical limitations of human beings. Smart wearable devices can be used to help some people with physical disabilities restore normal physiological functions. For example, color-blind patients can see the color world in the eyes of normal people through special smart glasses, and the deaf and dumb people can communicate with normal people with the help of equipment. In addition, smart wearable devices can also help to achieve communication between different language and ethnic groups. It uses exoskeleton wearable devices to achieve functions that break through the limitations of human physiology, such as easy lifting and falling of heavy objects.

(4) The ultimate stage of smart wearable devices is to realize the integration of the device and the human body, and gradually evolve into a part of the human

body. In the future, smart wearable devices will be integrated with the human body in a more intelligent way. The final form of wear will be wearless.

3.3. Stereoscopic Monitoring. The meaning of three-dimensional monitoring is to realize the monitoring of the data required by the system in an all-around way. The design of this system is inseparable from the combination of "Internet+" and smart wearable devices. The schematic diagram of the specific system measurement indicators is shown in Figure 4.

It is a portable and comfortable wearable instrument wireless network platform for research. It embeds an ECG measurement module, a pulse wave measurement module, a breathing module, a data storage unit, and a communication module into the wearable clothing through individual measurement modules and microcontrollers and only mobile phones or computers as user terminals. It constitutes the point-to-point wireless network connection of the Bluetooth interface and realizes the network transmission of measurement data.

No matter what is being monitored, in the final analysis, it is still the research object of human beings. Therefore, this study specially designed a model for human comfort, which well covered the main monitoring indicators of the human body. The details of the model are shown in Table 3.

The human physiological parameter monitoring model is composed of heart rate, respiration rate, blood oxygen saturation, and comprehensive evaluation of environmental parameters. Among them, heart rate, respiration rate, and blood oxygen saturation play a major role, and environmental parameters play an auxiliary role. The human physiological parameter monitoring model is shown in Figure 5.

In online management, it is necessary to integrate the network platform with data analysis and provide service management with scientific and reasonable fitness prescriptions. The three parts of the early warning service management with the smart wearable as the core need to be efficiently managed and operated in order to maximize the management efficiency. The schematic diagram of the system operation management structure is shown in Figure 6.

4. Smart Wearable Devices and Tennis Exercise

There are many formulas for the double exponential filter, and the gap between them is relatively small. The most commonly used formula definitions as follows.

Trend factor:

$$\beta_n = \lambda\left(\hat{\kappa}_n - \hat{k}_{n-1}\right) + (1-\lambda)\beta_{n-1}. \tag{1}$$

Filter output:

$$\hat{\kappa}_n = a\kappa_n + (1-a)\left(\hat{\kappa}_{n-1} + \beta_{n-1}\right). \tag{2}$$

$\lambda = 0.25$ in formula (1); κ_n in formula (2) is the input value to be filtered, with $a = 0.5$.

The acceleration output value is as follows:

$$A_{XO}[g] = G * \sin(\alpha). \tag{3}$$

In formula (3), G is the theoretical value of gravity, and the unit of the inclination angle α is radians.

$$\begin{aligned} \alpha &= \sin^{-1}\left(\frac{A_{XO}[g]}{G}\right), \\ \frac{A_{XO}}{A_{YO}} &= \frac{G * \sin(\alpha)}{G * \cos(\alpha)} = \tan(\alpha), \\ \alpha &= \tan^{-1}\left(\frac{A_{XO}}{A_{YO}}\right). \end{aligned} \tag{4}$$

It gets the parameters of sphere (μ, ν, ω):

$$\begin{aligned} \omega &= \cos^{-1}\left(\frac{A_{ZO}}{\sqrt{A_{XO}^2 + A_{YO}^2 + A_{ZO}^2}}\right), \\ \nu &= \tan^{-1}\left(\frac{A_{XO}}{A_{YO}}\right). \end{aligned} \tag{5}$$

It is proved by basic trigonometric functions:

$$\begin{aligned} \mu &= \tan^{-1}\left(\frac{A_{YO}}{\sqrt{A_{XO}^2 + A_{ZO}^2}}\right), \\ \nu &= \tan^{-1}\left(\frac{A_{XO}}{\sqrt{A_{YO}^2 + A_{ZO}^2}}\right), \\ \omega &= \tan^{-1}\left(\frac{\sqrt{A_{XO}^2 + A_{YO}^2}}{A_{ZO}}\right). \end{aligned} \tag{6}$$

Its piecewise interval mapping associates gamma values with specific pixels:

$$\psi(i) = \begin{cases} \dfrac{\pi i}{2i_0}, & i \in [0, i_0], \\ \dfrac{\pi}{2}, & i \in [i_0, i_1], \\ \pi - \dfrac{\pi(255 - i)}{2(255 - i_1)}, & i \in [i_1, 255]. \end{cases} \tag{7}$$

Gamma:

$$\sigma(i) = 1 + j\cos(\psi(i)). \tag{8}$$

Here, $j \in (0, 1)$ is a weighting factor.

Gamma correction:

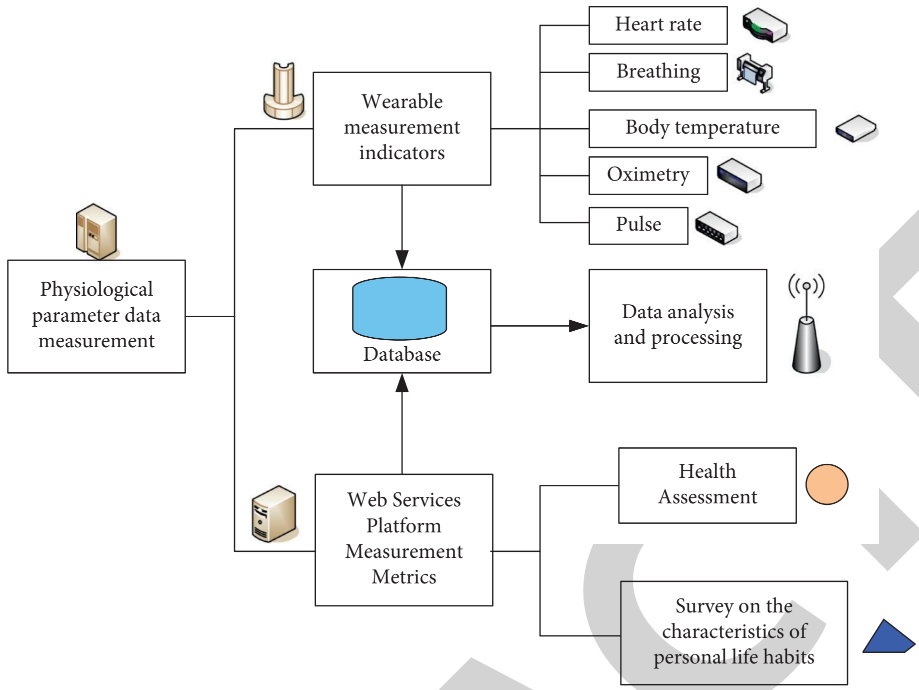


FIGURE 4: Schematic diagram of system measurement indicators.

TABLE 3: Human comfort evaluation model.

Comfort	Physiological parameters (PPs)	Environmental parameters (EPs)	Meet the conditions
Comfort	H_C, R_C, S_C	T_S, D_C	PP = 3, EP = 2
General comfort	H_C, R_C, S_C	T_S, D_C	PP = 3, EP < 2
Uncomfortable	H_C, R_C, S_C	T_S, D_C	PP < 3, EP = 2
Extremely uncomfortable	H_C, R_C, S_C	T_S, D_C	PP < 3, EP < 2

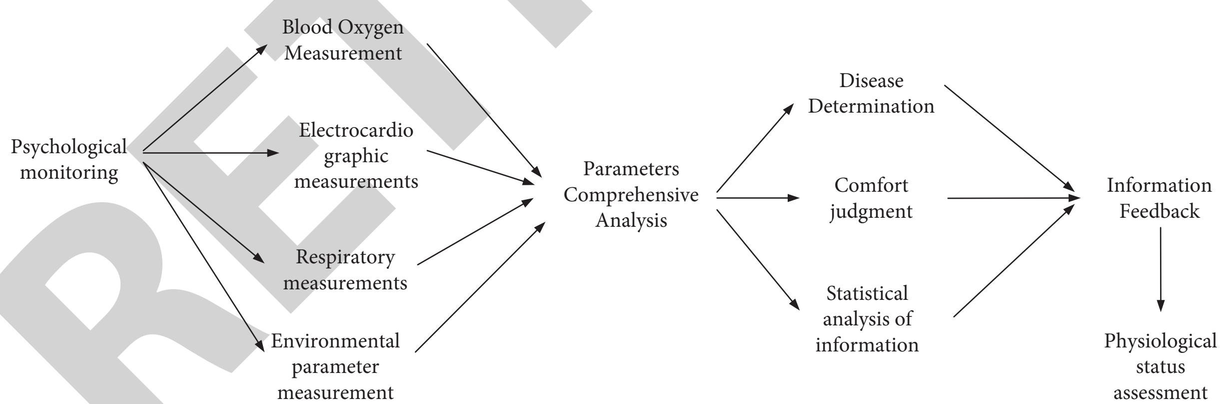


FIGURE 5: Human physiological parameter monitoring model.

$$\varepsilon(i) = 255 * \left(\frac{i}{255}\right)^{1/\sigma(i)}. \tag{9}$$

Highlights of pixels that divide the area:

$$\zeta_{\text{new}} = \begin{cases} \sinh(d * (2 * \zeta - 128)) + 128 & \text{if } \zeta < \zeta_{ave}, \\ \sinh(d * (e * (\zeta + f) - 128)) + 128 & \text{if } \zeta \geq \zeta_{ave}, \end{cases} \tag{10}$$

where ζ is the luminance signal value of the pixel in the YUV color space; ζ_{new} is the calculated new luminance value. $d = \lg(256)/128$; $e = 128/256 - \zeta_{ave}$; $f = 256 - 2 * \zeta_{ave}$.

The pixel brightness value in the divided area is calculated as follows:

$$\zeta_{\text{new}} = \frac{128}{\zeta_{ave}} * \zeta. \tag{11}$$

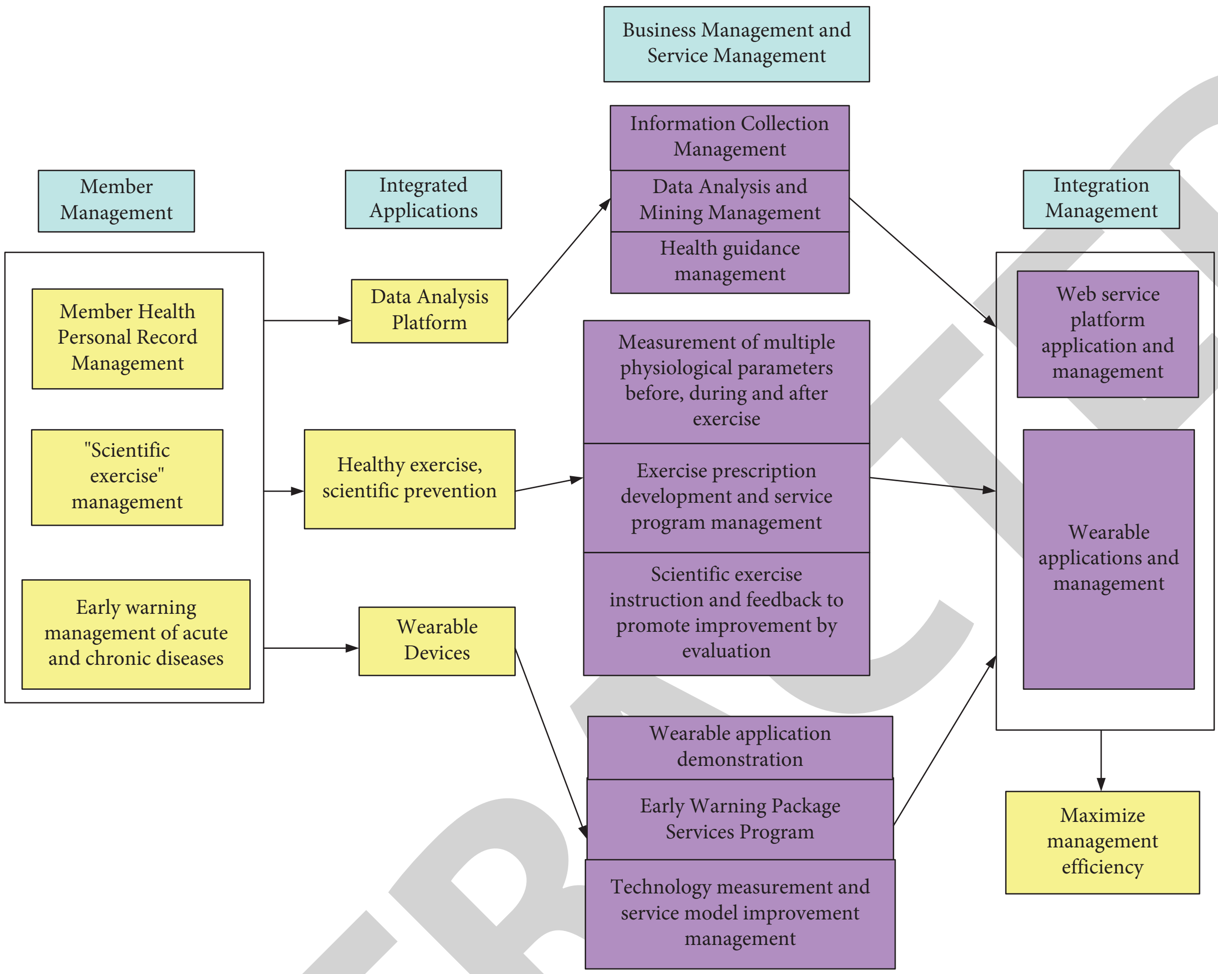
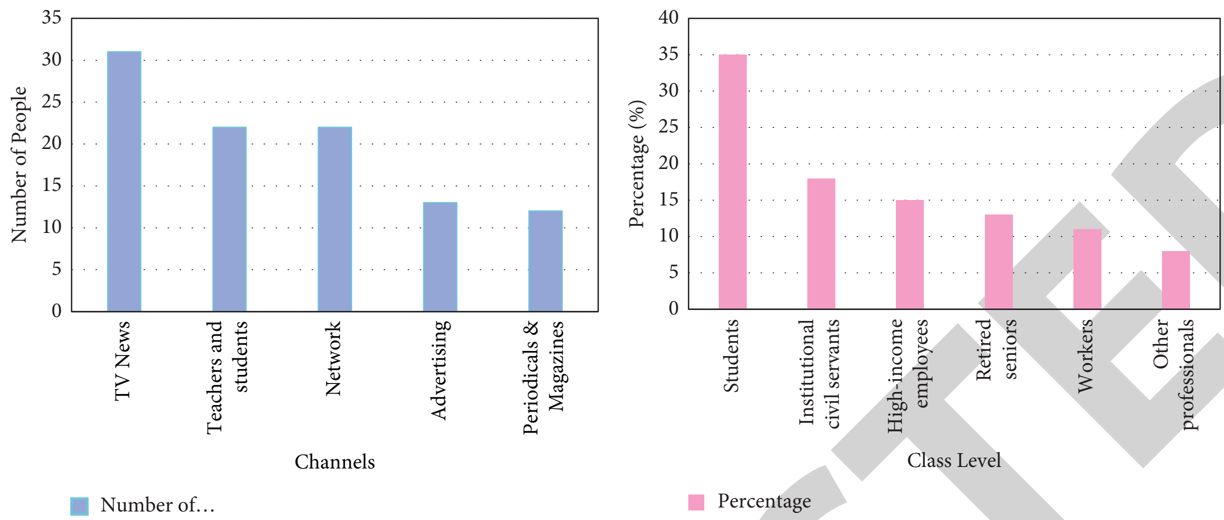


Figure 6: Schematic diagram of internal circulation operation management structure.

Figure 7: Survey results.



(a) (b)

FIGURE 8: Survey results.

The calculation formula of the moment in the image domain is as follows:

$$\rho_{ab} = \sum_{i,j}\left(\tau(i,j)i^a j^b\right), \tag{12}$$

where $\tau(i,j)$ represents an image.

The zeroth moment is the sum of the image brightness:

$$\rho_{00} = \sum_i \sum_j \tau(i,j). \tag{13}$$

The two first-order moments are as follows:

$$\begin{aligned} \rho_{10} &= \sum_i \sum_j i\tau(i,j), \\ \rho_{01} &= \sum_i \sum_j j\tau(i,j), \\ \bar{i} &= \frac{\rho_{10}}{\rho_{00}}, \bar{j} = \frac{\rho_{01}}{\rho_{00}}. \end{aligned} \tag{14}$$

The total population of a city is about 12 million people. This research found that there are nearly 400,000 citizens participating in tennis sports through actual surveys and the Internet. A questionnaire was conducted on the groups participating in tennis physical exercise in this city to obtain the ratio of male exercisers to female exercisers, as shown in Figure 7(a). The weekly frequency and time frequency of citizens participating in tennis exercises in their spare time are shown in Figure 7(b).

It can be seen from Figure 7(a) that the numbers of male exercisers and female exercisers are 294 and 126, respectively, with a ratio of 7 to 3. It can be seen from Figure 7(b) that 168 citizens of this city participate in tennis exercises three times a week. In general, the participation of the city's citizens is relatively high.

The survey provides the details of the channels for citizens to acquire tennis knowledge in this city, which are given in Figure 8(a). The specific situation of the participants in the tennis exercise in the city is shown in Figure 8(b).

Figure 8(a) shows that the citizens of the city are still more willing to learn about tennis and participate in it. Figure 8(b) illustrates that tennis has not yet spread to mass physical exercise in the city, but it is in a developing stage.

Table 4 shows the consumption motivation of tennis exercisers in this city to participate in tennis exercises.

It can be seen from the table that citizens participate in tennis sports mainly for physical exercise, which accounts for 34.2%. In addition, people with the purpose of entertainment and interpersonal communication accounted for 25.8%, which is still a lot of weight.

The system power consumption test results are shown in Figure 9.

Figure 9 shows that the voltage output of the system is maximum at 3.71 V, although in a standby state. But combined with the current output, it can be seen that the system consumes the least power in the standby state. In addition, it is known through calculation that the power consumption of the system is the largest under the GPRS working state.

The test tools used in this study are shown in Table 5.

The city's citizens' experience with smart wearable devices is shown in Figure 10.

Figures 10(a) and 10(b) are, respectively, the experience of the smart wearable devices of the bracelet type and glasses type by the citizens of the city. From Figure A, it can be seen that there are 216 citizens in the city who feel very comfortable with the bracelet experience. The overall good experience reached 393 people, reaching more than 93% of the surveyed people. In addition, although the experience of glasses-like wearable devices is slightly worse than that of bracelets, the overall is still good.

Table 4: A survey on consumption motivation of tennis exercisers in the city

Type	Number of people	Total number of people	Proportion (%)
Exercise	288	842	34.2
Recreation	112	842	13.3
Interpersonal	105	842	12.5
Weight loss	90	842	11
The pursuit of fashion	75	842	9
Job requirements	70	842	8.3
Learn tennis skills	40	842	4.8
Stress relief	40	842	4.8
Other	22	842	2.6

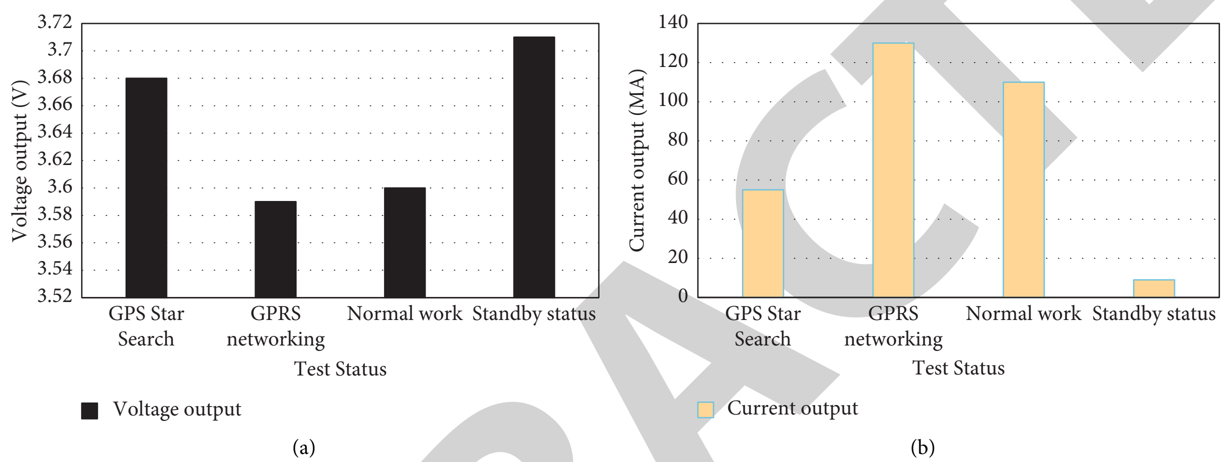


Figure 9: System power consumption test results.

Table 5: Test tools.

Test tools	Quantity
Multimeter	1
Oscilloscope	1
Electric soldering iron	1
3.7 V lithium battery	1
PC	1
Downloader	1
Communication line	1
Adjustable power supply	1

5. Discussion

In the experiment, the combination of Internet + and smart wearable devices is used to monitor various life parameters of the human body during tennis exercise. And in the selection of smart wearable devices, a combination of various types of wearable devices is adopted to realize the three-dimensional monitoring of data. The acquired data are uploaded to the cloud platform through Internet technology. The cloud platform system will analyze the personal physical condition and mark it according to the data indicators. If a person's index does not meet the index parameters of a normal human body, the system will send a prompt to the corresponding smart wearable device to the person. The person can choose the next exercise state according to the prompt received. The construction of such a three-dimensional monitoring has important and irreplaceable significance for tennis players. Three-dimensional monitoring is inseparable from the mutual cooperation of multiple technologies, and at the same time, it is also inseparable from the combination of software and hardware. There are many different ways to implement it.

The biggest reason for choosing Internet+ for this research is that the final three-dimensional monitoring is inseparable from data. The transmission of data is also inseparable from the network, and data processing is also based on the Internet. Therefore, Internet+ is selected as one of the basic technologies of this research. In order to realize the construction of a three-dimensional monitoring system, not only the combination of Internet + and smart wearable

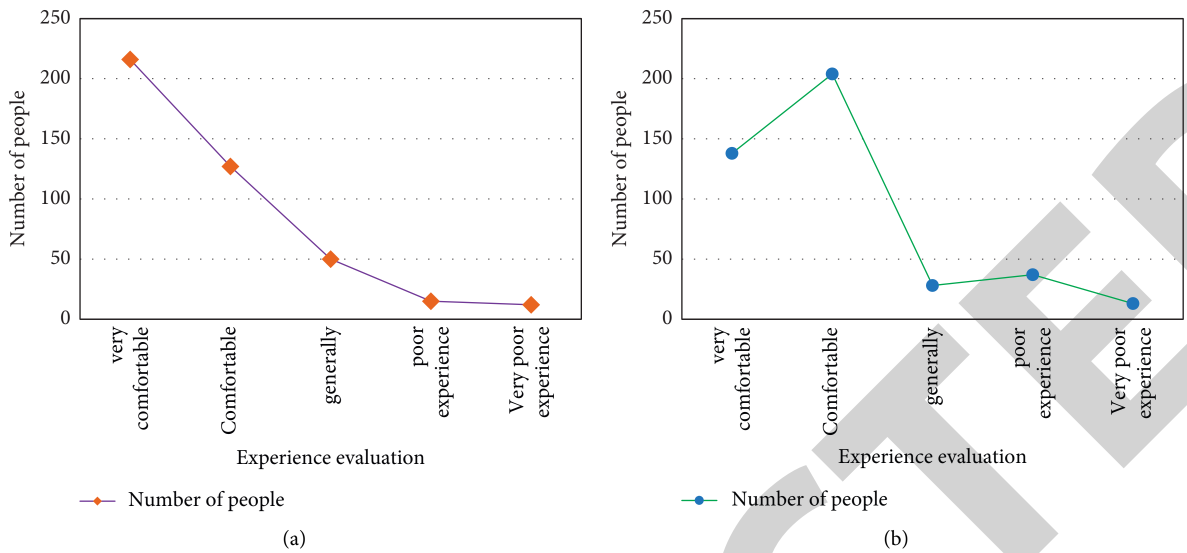


Figure 10: Citizens' experience with wearable devices.

devices is required but also the will of people themselves. After all, if a person needs to wear a lot of equipment during exercise, even if the weight of the equipment is not large, it will affect the mood and effect of the exercise. Therefore, how to make people naturally accept this project is also a question worth pondering.

6. Conclusion

Smart wearable devices adhere to the design concept of "people-oriented" and "integration of man and machine." Society is progressing, technology is developing, and our living patterns are also subtly changing with the changes in times. Just imagine, people do not need to turn on their phones, they just need to blink their eyes to know the weather tomorrow. There is no need for manual operation, and people only need to control the car system by voice to automatically start. When traveling, people no longer need to bring heavy luggage, and they only need to turn on the virtual spacer to travel around at any time and so on. We as designers are working in that direction right now. In the near future, smart wearable smart devices and even other smart devices will continue to improve their functions. It changes and even creates people's way of life with a more comprehensive human-machine experience mode. It will lead people into a new living space and experience a brand new interactive experience. This paper briefly summarizes the basic characteristics of smart wearable devices by systematically combining them. And through the analysis of the research status of smart wearable devices, the shortcomings of the research on smart wearable devices are found. Then, through the analysis of smart wearable interaction technology and interaction design principles, as well as the analysis of the development trend of smart wearable device service mode. It lays the foundation for the subsequent application of specific smart wearable devices. In the future, both Internet+ and smart wearable devices will be widely used and popularized.

Data Availability

Data sharing does not apply to this article as no new data were created or analyzed in this study.

Conflicts of Interest

The authors declare no conflicts of interest.

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