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Future Design Outlook of Wearable Devices

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ABSTRACT

The advancement of wearable device technology has enabled more comprehensive monitoring of the human body while also significantly contributing to the tracking of sports performance and analysis of physical health. Wearable technology is specifically designed to monitor and analyze biological indicators in real-time, such as breath detection, heart rate, muscle oxygen, and more, which can effectively monitor fatigue during exercise. These devices revolutionize how individuals approach fitness by offering personalized insights and real-time feedback on physical activity, sleep patterns, and other vital signs. Moreover, they incorporate an individual's physiological signals to influence their training programs. While wearable motion monitoring devices hold tremendous potential benefits, practical limitations need to be addressed for improved usability and functionality. These limitations include user comfort, monitoring accuracy, and privacy issues. However, the design of wearable fitness devices and their ability to predict future performance is an exciting area of research and development. In the future, we anticipate the emergence of more advanced and precise devices. By integrating cutting-edge sensors and machine learning algorithms to analyze real-time data, personalized recommendations can be generated, providing users with a holistic understanding of their health and wellness.

Keywords: Sports health monitoring, Health monitoring, Wearable device

INTRODUCTION

With the development of monitoring technology and computer technology, wearable health monitoring device (WHD) has brought a new experience of human-computer interaction mode, real-time monitoring (Dunn et al. 2018) of human physiological data in various environments, including in daily life Physiological data in quiet life and fluctuating physiological data in sports. This kind of monitoring equipment has been widely popularized in the fields of sports monitoring (Halson et al. 2014), personal physiological data monitoring (Heil et al. 2014; Zeng et al. 2014), sensitive monitoring equipment, monitoring equipment and highly integrated big data and computer technology can be very good Complete the goal of physiological monitoring (Yao et al. 2018). Notably, as extensively discussed by Peng et al. (2020), combinations of nanomaterials hold great potential for developing highly sensitive, selective, wide-range, and fast wearable sensors. However, more research is

needed to explore the potential benefits of wearable devices on human health disabling injuries for the system (Booher and Minninger, 2003).

Wearable technology encourages an active and healthy lifestyle, so it can be used to monitor physical activity. Wearable health devices can monitor some physiological indicators of the human body, such as: vital signs, such as heart rate, blood pressure and body temperature, and use electrocardiogram (ECG), ball-cardiac electrocardiogram (BCG), oxygen saturation, hydration, sleep patterns and other health indicators (Macera et al. 2003, Troiano et al. 2008, Solanas et al. 2014). This information can be used to assess and monitor changes in health status. Overall, wearable devices enable earlier detection and intervention of health problems by providing continuous, real-time monitoring of key health indicators (Jaewoon Lee et al. 2016).

Personal health status has received more attention with the development of society, and wearable health monitoring devices have become the choice of those who want to lose weight and increase aerobic exercise to improve their health (Case et al. 2015, Patel et al. 2012). Wearable health monitoring equipment can monitor sleep status, calorie consumption after exercise, heart rate in daily life, heart rate changes during and after exercise, exercise posture during exercise, etc. to obtain their own exercise Health status (Jaewoon Lee et al. 2016). The training program and the different choices of sports have a great influence on athletes (Borresen and Lambert, 2009). Users can formulate their own training plans and exercise intensity based on the data monitored by wearable health monitoring devices, so as to reduce the cumulative fatigue (non-functional overtraining) that may be caused by too much or too little training, and enhance exercise effects, only the appropriate training intensity meets the individual's physical training level can better stimulate the sports performance and sports effects during sports (Bouchard and Rankinen. 2001; Hautala et al. 2006, 2009; Borresen & Lambert. 2009; Manzi et al. 2009b, 2013; Castagna et al. 2011). The training effects, health and sports performance in different periods are inevitably related to the sports effects pursued by athletes, and wearable health monitoring devices can be personalized according to their sports status and adjusted according to different training cycles (Borresen and Lambert, 2009; Kiely, 2012; Plews et al. 2013b; Stanley et al. 2013a).

Our research comprehensively analyzes current research on wearable health devices in exercise and personal physical health monitoring. It identifies potential areas for future exploration while optimizing the software and hardware devices of wearable health monitoring devices. This paper aims to predict future research based on the current research level of wearable health devices, improve wearable health devices, and design a new wearable health monitoring device, pursuing a unique experience and health well-being.

Method

This paper uses search terms related to wearable health monitoring devices and wearable device design, including "wearable technology," "body monitoring technology," and "exercise monitoring." It analyzes data from retrieved articles and wearable health products. We found that head-mounted

wearables often come in several forms, such as glasses, face shields, and helmets, so we analyzed the structure, comfort, and monitoring and analysis technologies of these three forms of wearable health devices as a basis for intelligent wearable devices. According to ergonomic studies, the average person's face is about 18.5-22 cm long and 12–14 cm wide. We also searched for other monitoring technologies related to wearable health monitoring devices, such as "physiological hypersensitivity monitoring," "EEG monitoring," and "computer integration." We implemented intelligent monitoring glasses by combining ergonomics, physiological monitoring, and big data computing. By combining the above analysis and research, we design intelligent wearable devices with more comprehensive functions and better comfort to meet people's needs for physical health monitoring.

Design

Design features:

1. It adopts a unique head-mounted design, allowing users to experience immersive sports during exercise. Athletes can also see their sports and physiological data in real-time on the display screen.

2. It has EEG and heart rate monitoring functions, aiming to monitor EEG information and heart rate changes in real-time during exercise.

Operating system:

The device supports wireless connectivity methods such as Wi-Fi and Bluetooth. Storage: It comes with a 1.2GHz quad-core processor and 2GB of RAM, and 16GB of storage. Display screen:

Picture 1: Design pictures of the wearable glasses.

The device comes with a 0.39-inch Micro OLED display with a resolution of 1280x720, which can display high-definition video and images on display.

Voice Control:

Support voice control function, you can complete a variety of operations through voice commands, such as taking photos, playing videos, adjusting volume, etc.

Camera:

The device is equipped with two 12-megapixel front-facing cameras that enable functions such as video calls and remote support.

Protection performance:

It is IP66-waterproof and dustproof and can drop at a height of 2 meters.

Intelligent

We design smart wearable glasses made of soft, breathable, durable materials that the user can comfortably wear. Among them, smart glasses have a variety of built-in sensors and chips, which can realize a type of health monitoring and motion recognition; mirrors can monitor the user's heart rate, blood pressure, sleep quality, steps, calories consumed, and other physiological data in real-time and send these data to the user's mobile intelligence or another intelligent device through wireless communication methods such as Bluetooth or Wi-Fi. At the same time, the glasses are also equipped with an OLED display, which can visually display the user's movement data and health status to understand his physical condition quickly.

In addition, users can also connect glasses through the mobile APP, view more detailed exercise data and health reports, and carry out personalized health management and planning arrangements. For example, users can set target steps, sleep duration, diet plans, etc., and adjust and optimize them according to individual circumstances. Overall, this smart-glasses design is simple, practical, easy to operate, and has a variety of health monitoring and exercise tracking functions, which can help users better grasp their health and achieve scientific management intelligently. At the same time, smart glasses also have good reliability and safety, effectively protecting users' personal privacy and data security in daily use.

Discussion

1. Current application scenarios of physical health monitoring:

At present, wearable devices are widely used in physical health monitoring. Some everyday use cases include exercise monitoring, sleep monitoring, heart rate monitoring, blood pressure monitoring, and comprehensive physical health management. For exercise monitoring, wearable devices can monitor data such as users' steps, running speed, calorie consumption, and exercise distance in real time. They can also provide users with personalized suggestions and feedback to help them train and adjust better. In terms of sleep monitoring, wearable devices can assess the user's sleep quality by monitoring the user's sleep patterns, deep and light sleep time, and waking time, providing recommendations for sleep quality improvement. For heart rate monitoring, wearable devices can monitor changes in the user's heart rate in

real-time through optical heart rate sensors and help users assess their cardiovascular health. For some wearable devices, blood pressure monitoring can also be implemented, and the user's blood pressure value is calculated by analyzing the user's pulse waveform through intelligent algorithms. In addition, wearable devices can also monitor the user's physical condition by combining a variety of physiological indicators and help users carry out comprehensive physical health management, such as diet monitoring, blood glucose monitoring, etc.

2. Application scenarios of sports health monitoring:
In the fitness industry, wearables are the most common monitoring devices we encounter, such as breath, heart rate, blood pressure, etc. Based on the results of 7 studies investigating the effects of wearables on physical activity, we found that wearing wearables while exercising improves our comfort significantly (Cadmus-Bertram et al. 2015, Martin et al. 2015, Patel et al. 2012, Annette Dean. 2013). After wearing wearables, users tend to use them to monitor their body movements (such as by incorporating location-based trackings such as GPS, motion tracking using accelerometers and gyroscopes, and physiological search through heart rate monitors). This makes it possible to calculate user logs such as distance traveled, calories burned, and average speed. After aerobic exercise, wearable health devices can optimize exercise intensity and activity training planning based on post-exercise fatigue levels. However, the values obtained by these monitoring users can clearly understand the positive results after exercise, which may have some degree of improvement in an individual's motivation to exercise. At the same time, users can monitor their health and physical functions through wearable devices to understand their current sports performance and bodily functions. Some wearables can even combine the user's physical condition with different daily exercise consumption to provide positive feedback to the user and promote daily physical activity. Wearing wearables can improve physical activity time, further improving physical function and health (Jovanov and A. Milenkovic. 2011).

3. The usefulness of the design:
Wearable intelligent monitoring glasses are designed to help immerse themselves in sports during exercise, the LCD screen in front of the eye can be based on a virtual sports environment of the athlete for an immersive experience, and the headset device has two detectors, which can detect obstacles in front of them in daily life, Real-time feedback reduces road safety problems encountered in everyday walking. Smart wearable glasses also have EEG monitoring and heart rate detector by monitoring the temporal artery and forebrain scalp for EEG and heart rate monitoring; for the exercise process, the EEG changes and heart rate changes brought about by real-time monitoring, real-time monitoring, and analysis of exercise performance and fatigue, can get their training analysis report after training can better plan their exercise plan.

GPS, accelerometer, voice recognition, voice assistant, and other functions are equipped on the changed device; in addition, you can also interact

with the Internet link for data, and the mobile phone link can get a more comprehensive personal health analysis report and other function expansion, wearable devices must be easy to use, comfortable and visually attractive. A well-designed interactive interface can significantly increase user interest in wearable devices and their overall experience when using them, which is mainly used in the field of sports health, and personal physical health monitoring, and aims to improve the efficiency of athletes and ultimately help them achieve their health goals more effectively.

4. Challenges:
In the future, wearable fitness devices could revolutionize how people approach fitness and health. Real-time performance prediction can give users a more accurate and personalized view of physical activity, allowing them to optimize their training and recovery. Customized guidance and advice can help users achieve their fitness goals more effectively. Computer integration technology and new monitoring equipment are the development and application of intelligent wearable health monitoring devices and have become the main future thinking direction of future clever wearable health monitoring device design.

The practical application of wearable technology still faces many challenges and problems (Perrey et al. 2018). Designers must consider factors such as design studies of wearable devices, monitoring accuracy, analysis of target audiences, and more during the design process. Wearable activity monitors also require calibration practices for standard monitors, clarify monitoring cycles, including weekdays and weekends, and reduce the extent of monitor errors. Computer systems also play a vital role in wearable devices, computer systems with high computing power, and the flexibility of electronic components (chips, integrated circuits, batteries, electronic screens, etc.). It will also be pursued in the future. A significant challenge is collecting and processing body monitoring data from wearable activity trackers and using this data to predict physical health outcomes. However, by monitoring daily body and exercise data, we can provide timely feedback to users and use data visualizations to predict future health outcomes. Wearables can also promote healthy lifestyle habits and provide targeted feedback to track an individual's physical movement progress, ultimately better predicting future physical conditions and health trends. The physiological monitoring of users and personal data belongs to the privacy of individuals, and better protection of users' privacy is the design policy of our wearable devices. In the future field of wearable device design, smaller, more comfortable, more efficient, and more private is one of our pursuits in wearable devices.

Conclusion

Smart wearables are a new avenue for human-computer interaction, utilizing devices worn on the body to offer consumers unique and personalized services. The emergence of mobile Internet technology and advancements in the core hardware technologies of wearable devices, such as low-power chips and flexible circuit boards, has paved the way for wearable devices to transition from mere conceptual ideas to commercial products. As a result, new

and improved wearable devices are being introduced to the market, featuring enhanced intelligence, diversity, accuracy, and formality.

The emergence of mobile Internet technology and advancements in the core hardware technologies of wearable devices, such as low-power chips and flexible circuit boards, has paved the way for wearable devices to transition from mere conceptual ideas to commercial products. As a result, new and improved wearable devices are being introduced to the market, featuring enhanced intelligence, diversity, accuracy, and formality. In wearable health devices, we aim to achieve compatibility across various scenarios. This means wearables should be able to provide real-time information and intelligent assistance in different work settings, such as voice recognition, gesture operation, and other functions. By doing so, users can complete tasks more efficiently. Wearable devices can monitor body data such as exercise amount, sleep quality, and heart rate in daily life and provide personalized suggestions and feedback to facilitate the user's health management. Wearable devices integrate many components, affect comfort when wearing, and their biocompatibility is also a problem to consider, with the development of wireless transmission and new materials can enhance the intelligence of the device and reduce the volume of the device to make it more comfortable to wear is also the future we pursue.

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