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Wearable computer device design for environmental perception system

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Abstract. With the growing popularity of smart devices, wearable computer devices are being more and more attention. The environment perception system of the wearable computer equipment design and research of this subject was analyzed in this paper, the connotation of environment perception technology and its effect were mainly introduced, at the same time, the wearable computer equipment content and research methods of the paper were explained, finally the research results were discussed and analyzed. The results show that the wearable computer equipment can better realize the function of human computer interaction with the support of environmental sensing technology, which provides a favorable research direction for the design of wearable computer equipment.

Key words. Environmental perception, wearable computer, equipment design, application research.

1. Introduction

Stana believes that the development of wearable computers dates from the mid-1950s. The first wearable computer is limited by the hardware and software, therefore, the first wearable computer in all aspects is at a low level [1]. The wearable computer has only a few simple buttons, the size of which is similar to that of a cigarette case. At the same time, the first wearable computer can only control their own data acquisition device to get the speed of the disc and the results of the data of feedback and transmission. Therefore, the first wearable computer is relatively low, but this does not have a negative impact on the continuous development of wearable computers. By the end of 60s, the wearable computer has the function which can read lips and eyes that is worn on the human body function. At the same time, some researchers use a filter to achieve the display of the function of pronunciation. Wearable computers in this period are still in the primary stage of a single function does not have the ability to program. Mann believes that the continuous development of the integrated circuit manufacturing industry in 80s provides a good basis

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for the continuous improvement of wearable computers. At the same time, a lot of researchers and institutions also pay more and more attention to the research of wearable computing. According to the needs of different industries, they have made a lot of research on the functional applications of wearable computers [2].

International Conference on wearable computer in 1997 by MIT and Carnegie Mellon jointly organized by many universities in the United States, and the U.S. Department of defense research institutions and Boeing also give support to wearable computer conference. Lin believes that wearable computer has become a very important academic research object; its potential value is also in many different industries gradually demonstrated. European research institutions in many developed countries have carried out a lot of researches of wearable computer technology and have formed a relatively stable industrial chain [3]. Our country's wearable computer research is from the beginning of 90s. In the early stage of our country, the related research is realized through the interaction between the host computer and the peripheral devices and sensors. Chongqing University in 2000 withdraws the wearable computer prototype. Leder believes that the centralized structure needs to be equipped with a large number of sensors and human-computer interaction devices. Although this structure can collect data, it has a certain degree of negative impact on human comfort [4]. Therefore, wearable computer is currently the most widely used in embedded watches and hat and other control chip. So far, the most popular product of wearable computer is the Google Corporation Glass Project. This product has completed its research and begins to sale. But the high price of this product has not been popular with the public. The purchase of this product is more scientific research staff. In recent years, our country for wearable computer research has just started, the research institutions most are the professional institutions. In summary, with the development of the globalization of the computer network and the intelligent equipment, it is very important to design and research the wearable computer equipment for the environmental sensing system. Based on the relevant theories at home and abroad, this paper analyzes and studies the design and research of wearable computer equipment in the system of the environmental perception system through the method of system experiment and model construction. In the second section, the connotation of environmental awareness technology and its role in the design of wearable computer devices are described. In the third section, the main content of wearable computer equipment design is introduced, and the research method of the design of wearable computer device which is opposite to the environment perception system is described. In the fourth section, it lists the specific data and the analysis and discussion of the system experiment and model construction. At the end of the fifth section, the results of this research are discussed.

2. State of the art

2.1. Environmental sensing technology

Parson believes that the continuous application of environmental sensing technology in life has brought more and more benefits to the production and life, thus

promoting the continuous research of environmental awareness technology. With the development of science and technology and the tendency of intelligence, there are more and more researches on the technology of environmental perception [5]. Figure 1 is the study and discussion of the environmental perception system of the academic activities of the scene.

Fig. 1. Environmental awareness technology conference

Bogner thinks environment perception is an important technology of pervasive computing, which involves the main content of this technique of environment information of modeling, information acquisition, processing and other aspects of rule reasoning excuse the main content of this technique. The difference between the actual environment and the purpose of the application is different, so that people form a different definition of the environment [6]. Most of the researchers understand the environment around the application environment and the actual situation, also includes the application execution environment overall, the main computing environment, physical environment and user. Generally speaking, the environment refers to the user's location, the surrounding people and other objects and their changes. Lien thinks from the point of view of the system function, the environment perception system, the user's location, and people around the user and resources have a certain understanding. Environment is constantly changing [7]. Pellerin thinks the main contents of green space environment that sent including computing environment, user environment and the physical environment in three aspects. Table 1 is the detailed content of the environment space. Environmental perception calculation can be made through the perception of environmental information and its response to the examination and interpretation [8]. Environment perception calculation is based on the user and the system's environment information to carry on the dynamic change and adaptation. For environmental perception system, the ability to perceive the environment in the character and material information and the characters of the interactive command figure is the basis, and then make the reasoning on

this basis judge and adapt the service strategy. Therefore, environmental awareness technology can help users reduce the unnecessary burden on the interactive process and develop the level of the characters in a certain extent. The development of environmental sensing technology has made its application scope more and more extensive. Figure 2 shows the research of the present robot that has been applied to the environmental sensing technology.

Table 1. The content of the environment space

Category	Content
Computing environment	Processor input, Device, Computing costs
User environment	Position, Crowd around, Social status
Physical environment	Temperature, Humidity, Illumination

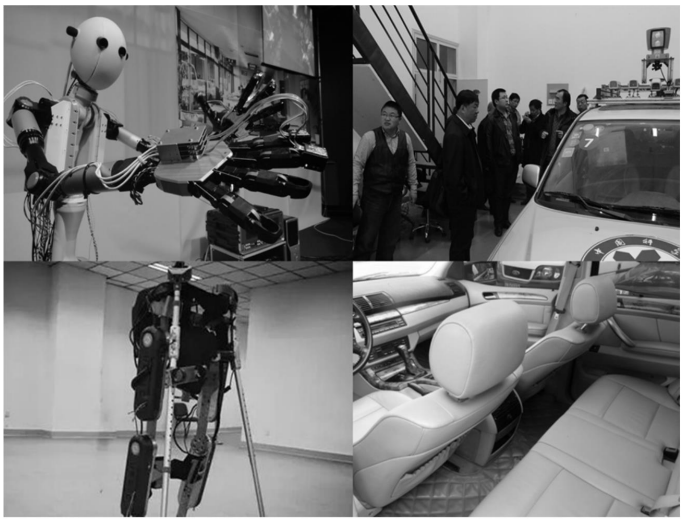

Fig. 2. Application of environmental awareness technology

Hassan believes that the perception of the environment structure is equivalent to a lot of different types of heterogeneous devices, such as sensors, mobile terminals and other software and hardware collection. The service provided by the system is completed by different devices [9]. This is mainly because the amount of information that the independent equipment cannot meet the requirements of the system and the user, with a certain degree of dispersion. Information of different equipment is different in form and way of acquisition, which is usually presented in an abstract way. At present, there are different levels of differences in the data structure of the modeling of the environmental sensing system, and the ways and methods of modeling are different. Sang believes that in the traditional environment, the access to information is generally achieved by direct access to the way the sensor device. This leads to the limitation of hardware binding in the development process [10]. The way of obtaining this information is not flexible enough, but it is most convenient

in operation. Based on the hardware sensor abstraction and processing by middleware, shielding upper application direct the operation of the underlying hardware can be abstracted hardware package and bind with the application layer, in a certain extent, which greatly improves the flexibility and expansion performance, which greatly reduces the limitations of hardware binding. Oliver thinks that the difference of the interface of the environment perception system is decided by the different users. The common interface of the environment perception system mainly includes three kinds of traditional API interface, database interface and event callback. The traditional API interface is usually the application program interface. The system provides access to the upper level application directly to the processing procedure interface, which is similar to the dynamic link library, and provides the interface style. At present, many network operators for their products with a suitable application interface to meet the needs of different developers. This kind of application program interface has the function of sharing, in a certain degree; it provides the convenience for the programmer. The interaction between the perceptual system and the database is inevitable. Database interface is essential between the two. The database interface is also designed for the data operation of the environment perception system. Callback method is a method of automatic operation after the end of the operation. Event and callback have a certain similarity in the mechanism. But, relatively speaking, the event is much easier to use than the callback. Environment perception system has its own rules. When the environment happen some changes, the system should take the environmental information and the environmental rules as the basis to carry on the adaptive change. Environmental rules mainly refer to the rational reasoning of environmental information behavior, which is based on the reasoning and conflict detection of middleware. Environmental reasoning is based on the environmental information database, which is built according to the environment model, and the reasoning mechanism of each environment model is different. Modeling the environment perception system mainly marked configuration model, value model, graph model and object-oriented models. The tag configuration model is a model that uses a markup language with a hierarchical structure to represent the environmental information. The main carrier of this model is the transmission of Internet information. The accuracy and convenience of this model are very high, but the relationship between the environmental information is difficult to distinguish. The graph model is more common, and its content is rich, and the model also has the characteristics of visual expression. But the graphics model needs to be abstract and has the computer language conversion processing.

3. Methodology

3.1. An overview of wearable computer device design

Ross believes wearable computer can be classified into the user's personal space; the user can operate and control the computer. Wearable computer has certain stability in the operation and interaction. Wearable computer has a certain continuity of the open state, at the same time, wearable computer access has its characteristics

at any time But Bulling believes wearable device mainly refers to the clothing and accessories and equipment, these devices can be provided for people to wear, one for wearable devices play the role of the carrier. Wearable device is a kind of portable equipment, which is based on the human capacity and equipment function, to a certain extent, to achieve the concept of human products. Thus, the concept of wearable devices is people-oriented, human and machine integration. At the same time, the realization of wearable device function is closely related to computer equipment and technology. The continuous progress of science and technology makes people tend to understand the understanding of wearable devices. In fact, the wearable device is not just simple smart equipment, in addition to its wearable function; it can also provide more specific services for people. In the globalization of the Internet today, wearable devices have been equipped with a variety of electronic hardware and the application software is provided for user. Wearable devices and most of the traditional electronic equipment, there is a big difference. Wearable devices have a lot of different ways of wearing, at the same time; these devices can also be worn at different locations in the human body. With the continuous development of wearable device design technology, the interaction between people and the machine will produce a variety of different ways. On the whole, different wearable devices have their own different characteristics.

Wearable computer equipment and the definition of a wide variety of devices, the standard measure of wearable devices also have a lot of different types and Haas Moto believes that the classification of wearable devices also have a lot of standards. From the perspective of the shape, wearable devices can be divided into glasses, watches, helmets and accessories, etc. A glass type wearable device is the main representative of wearable devices, Google glasses is a typical wearable device glasses. Some enterprises in our country also produce and sell similar products. However, this product is not yet more practical and in line with the user's products, most of the glasses wearable devices are still in the initial stage of the enterprise. The glasses type wearable device in general is mainly composed by battery energy, interactive systems and data processing core components. The main function of this kind of product is to realize the function of the intelligent mobile phone through the glasses. Smart glasses are prominent features of their interaction system. This system can help the smart glasses through speech and eye movement to achieve human-computer interaction throughout the process, in a certain extent; it is liberation of the people's hands. In addition, the smart glasses achieve a realistic and virtual space conversion to make human-computer interaction more humane. Wearable devices are generally semi covered or full coverage of the product. Starr leaf believes that helmet wearable devices and glasses wearable devices in the shape of little difference. However, there is a big difference between the technology and the smart glasses in the technology application. At present, the helmet wearable device is mainly applied to the VR virtual reality technology. Virtual reality helmet will provide a virtual three-dimensional space, when the user to wear a helmet after exposure to this virtual environment, the user generated an immersive feeling. Virtual reality is a completely virtual environment, this technology is characterized by its application to a lot of specific environment of the training and game scenes. There-

fore, many companies believe that the virtual reality helmet has a great space and value in the future development. Watch type wearable devices in the form and the traditional sense of the watch is similar. Wearable devices, however, it has a built-in computer smart chip and operating system. At present, the wearable watch is no longer a simple timing tool, but also has the function of smart phones. Wearable devices and wearable devices have the same structure. The user can operate and control the watch by touch and voice. Many companies have studied and released an equipment of wearable watches. Apple Corp's Watch Apple is a typical representative. In fact, the wearable device is a watch type of smart phones. From the point of view of market sales, its popularity is quite general. Users do not like the smart watch is mainly due to the neglect of the smart watch style wearable devices lack of its own characteristics. In addition, the performance of this type of wearable devices is generally wearable devices. But the role of Apple smart watches in the health and medical field is still worth the affirmative.

3.2. Research method of wearable computer device design for environmental sensing system

This paper mainly uses the method of system experiment and model construction to study and analyze the research and analysis of the design and research of wearable computer equipment for the environment perception system. The specific method of the system experiment is to verify the rationality and practicability of the wearable device design by testing the response of the environmental sensing system. In the process of building the main application formula (1) and the formula (2) reduce the degree of freedom of the algorithm, while the formula (3) and the formula (4) are for vector iteration. After the model is constructed, the process of the whole system experiment is finished by the test method of the system's requirement and the result output.

$$\{x_n\} = -\left[K_{nn}\right]^{-1}\left[K_{nm}\right]\{x_m\}\ , \tag{1}$$

$$[U] = -\left[K_{nn}\right]^{-1}\left[K_{nm}\right]\ , \tag{2}$$

$$[\phi] = [K]^{-1}[M]\,[\varphi]_{\text{old}}\ , \tag{3}$$

$$[\varphi]_{\text{new}} = [\phi]\,[Q]\ . \tag{4}$$

3.2.1. Result analysis and discussion The results obtained by the method of system test and model construction are shown below.

Figure 3 shows the change of the feedback information of the wearable device to obtain the feedback information of the environment, and also can see the dynamic change of the wearable device in the process of human-computer interaction. The coefficient of the model of the wearable device is low, and the linear correlation between the click time and the difficulty coefficient of the corresponding model can be reflected to a certain extent. From the results of the system test, the wearable

device is difficult to control. This is mainly by the operating mode of the device is more single, more with the thumb alone operation. Compared with other wearable devices, this problem should pay more attention in the design process of wearable devices.

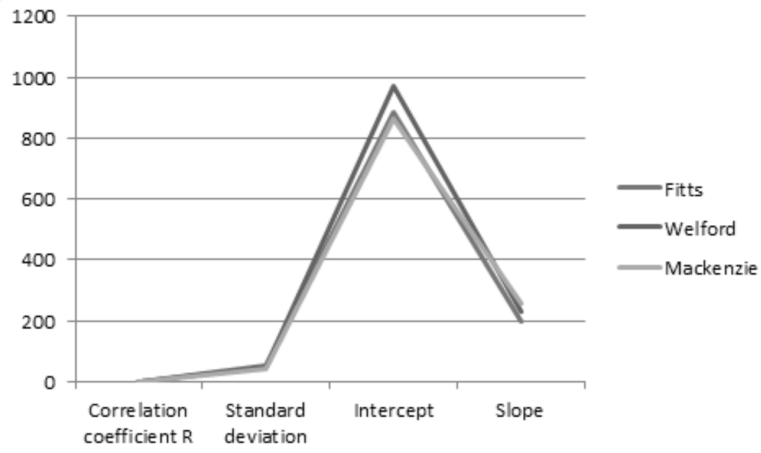

Fig. 3. Experimental results of Twiddler

Figure 4 depicts other wearable devices to a certain extent than wearable devices such as wearable devices and other visual perception wearable device model coefficient is higher. At the same time, the dynamic changes of the situation are also more stable. This is mainly because the other wearable devices operating mode is more convenient. Compared with the single mode of operation, the operation mode of the device is improved greatly, and the user experience is improved. This has a very important positive impact on the application of wearable devices. In addition, from the point of view of the feedback information, the performance indicators of these wearable devices are also higher than the first wearable device.

Figure 5 depicts through different test environments and different models of the construction and test of the results of the comparison of the various coefficients. Both of these two regression models reflect the length of the reaction time and the difficulty of operation to a certain extent. Under different test conditions, the operation difficulty of the wearable device is not changed, and the performance index of other wearable devices is relatively stable under different conditions. Thus it can be seen that the operation of the device is difficult to wear and the user experience is closely related to the user experience. At the same time, it can be seen that the application environment of wearable device has low impact on its use effect and its own performance. Therefore, in the actual design process, the staff can be from the perspective of environmental awareness technology to improve the simplicity of the operation of the product to carry on the reasonable design of wearable devices.

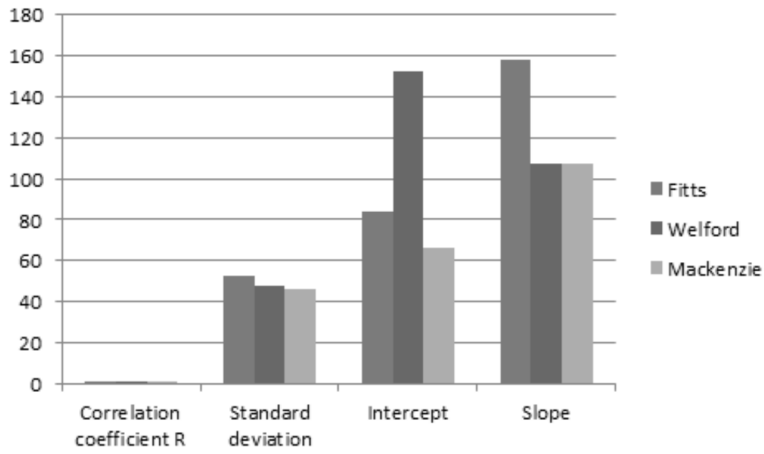

Fig. 4. Experimental results of Mouse

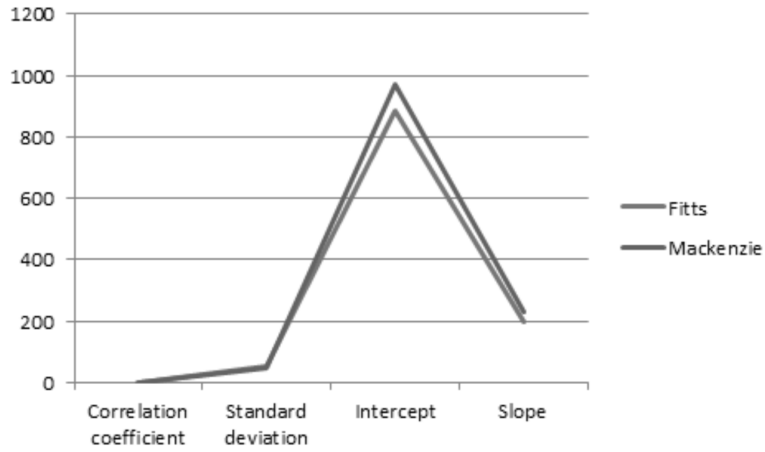

Fig. 5. Results of model data comparison

4. Conclusion

With the popularity of smart phones and applications, the wearable devices which can be used got more and more people's attention and welcome. Therefore, it is very important to design and research the wearable computer equipment for the environmental sensing system. Environmental sensing technology to a certain extent, it has promoted the development of wearable computer equipment. In the process of design and research of wearable computer equipment for environmental sensing system, wearable computer equipment is more widely used. Compared with other wearable computer equipment, the performance coefficient of the head mounted computer equipment is slightly lower than that of other wearable computer equipment. In the operation mode, the head mounted computer equipment has some disadvantages,

and the single operation mode has a certain degree of negative impact on the user experience. And other wearable devices in different test conditions, the performance index of the level is relatively stable.

In summary, the wearable computer equipment for environmental perception system still exist some problems. In the actual design process, the staff should improve the degree of attention of the user experience; from the perspective of equipment operating mode effectively improve the equipment, so as to promote the development of wearable devices.

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