A Case Study of Air Cleaner by the Intelligent Interaction and Emotion

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Abstract. The pure and fresh air can not only contribute to our physical and mental health, but also can be beneficial to ease the pressure and relax the mood. The vertical intelligent air cleaner can remove the harmful gases from the air and absorb the suspended particles in the air, especially all kinds of the bacteria and viruses. The air cleaner is good for improving the air quality of the indoor and maintaining the health of the people. The designing of the vertical air cleaner is as follows: The designing of the vertical intelligent make full use of the developed air purification technology. The smart home is inserted into the work. Simultaneously, in the aspect of the design of intelligent products, the intelligent interactive processes are scientifically planned. Moreover, the emotional design and the user experience are fully considered, which can enhance the comprehensive design ability.

1. Introduction

With the development of industrialization, the air pollution is becoming more and more serious. There are nine major chemicals in the air which can cause serious harm to human health. Excessive absorption of these chemical poisons can lead to multiple diseases and life-threatening conditions. The air pollution sources indoor mainly come from four aspects, such as the cement, the paint, the paint and furniture, as well as the household appliances and other indoor equipment, as well as the heating and cooking process. Persons live and work in the indoor environment in the most of the time of the day. The air quality indoor is the guarantee of healthy living, so keeping the air fresh and healthy can improve and enjoy our life.

There are major of reports about developing the air cleaner products. A new bench test for quantitative laboratory of air cleaner silencing is introduced [1]. With the development of date sample and intelligent-control technology, the hardware and software design and application of the new kind of intelligent digital air cleaner is applied [2]. Using a numerical simulation method and experimental method, the optimal design of acoustic performance for air-cleaner was presented and evaluated.[3] The air purifier is designed with a single chip which can absorb, decompose or transform all kinds of air pollutions.[4]Forming parts using a single kind of recyclable material is the most effective way to satisfy the requirement which is eco-friendly to the environment and a new air cleaner filter is developed.[5] A finite element model an automotive air cleaner is established with FEA model.[6]

In this paper, the innovative design of a vertical intelligent healthy air machine is completed, and the existing patent of air purification core technology is fully adopted. At the same time, in the intelligent design of the product, the intelligent interaction flow can be
scientically planned, and the emotional design and user experience should be fully considered, and the comprehensive design capability will be improved.

2. Social needs

2.1 Use the crowd

Women, especially pregnant women. Because women have a thicker fat, benzene absorbs easily and is quickly stored in fat, so women should pay more attention to benzene. Women should avoid contact with decoration during pregnancy.

Children. Children's bodies are in developmental stages, the immune system is more fragile, and their breathing rate is 50 percent higher than that of adults. It makes them more vulnerable to indoor air pollution damage for a long time indoor. The body of the Children is in the critical period of growth and development. With a long time inhalation of smoke, harmful gases, bacteria and viruses, not only it is easy to induce a variety of diseases, but also it attack the children's body function by the chronic effect, thereby affecting the normal development of height and intelligence.

The elderly. As the body enters its old age, various indicators of the body have gradually decreased, and it is easy to be affected by air quality.

Patients with respiratory diseases. According to the survey, 68 percent of the human body's illnesses are related to environmental air pollution. The most common human disease is the respiratory infections, and its symptoms can range from an implicit infection to a life-threatening illness.

People living in cities or areas where air quality is poor.

2.2 Applicable places

a. Newly renovated or renovated residence.
b. The residence of the elderly, children, pregnant women and newborn.
c. Home to asthma, allergic rhinitis and pollen allergens.
d. The residence of keeping pets and livestock.
e. Dwelling place that is more closed or affected by second-hand smoke.
f. Hotels, public places.
g. Living in high quality.
h. Hospital which can reduce infection, prevent transmission of disease.

3. Standard and core technical theory

3.1 Standard

a. Cleanliness. The clearance rate of PM2.5 and PM10 are above 95%. Effective intervention of radioactive radon is achieved by 99.9% clearance.
b. Temperature. Winter: 16-24 °C; Summer: 22-28 °C.
c. Freshness. The new air volume is above 30 cubic meters per hour. The amount of oxygen is comparable to that of local outdoor level. The content of 12 poisonous and harmful chemical gases will be reduced to the national standard, and the content of unpleasant odor will be reduced by more than 95%.
d. Humidity. Winter: 30-60%; summer: 40-80%.
e. Bacteria. The bacterial content is reduced to the national standard.

3.2 The Key Theory

3.2.1 The core theory. The core theory include purify and replace, which continuously the fresh clean air is injected, and the turbidity gas is expelled.

3.2.2 The Core Technologies. The Positive Pressure Shielding: Air is a fluid of gaseous substances. The room is viewed as a unclosed container, and constantly fresh clean air is injected to the room. The air indoor will continue to increasing under the positive pressure.
condition upper and it will force the interior air pollution to outside leakage through doors and windows, exhaust pipe and channel. Not only it can make indoor air pollution gradually dilute and extrude outdoor side by side, but also can prevent the untapped air outdoor returning home freely, with it form the positive pressure blocking for the outdoor air. As a result, it ensure the long-term stability of the indoor air quality.

The Photoelectric Purification System: Because of air ionization characteristics, the photoelectric purification system release millions of high concentration negative ions in every second to achieve environment best, and make the dust particles in the air negatively charged and then captured and adsorbed by the high magnetic electrostatic field.

3.3 The Purification Process
The outdoor fresh air is sucked into the indoor air quality optimization machine. The new air is treated clean from the inside of the machine, and the removal rate is above 95%, which is better than the national standard. The clean air is sterilized (the rate of bacterial inactivation is above 97%), which the total number of colonies is less than the standard value of the standard. The detoxification air continues to be treated with the odor, and the contents of the 13 pollutants and the unlisted TVOC contents are lower than the national standard. The above optimization air can meet the requirements of physical parameters in the national standard after the temperature compensation and humidification treatment. The air quality is further improved by adding negative ions and natural flavors and make it a healthy air. Then the healthy air will be continuously injected into the indoor to meet the new air consumption requirements of more than 30M3 per person per hour. The healthy air gradually dilute and squeeze out the indoor air, thus achieving a comprehensive optimization and management of indoor air quality.

4. The Project Design
4.1 The Product Design

4.1.1 The Design Concept. The upper part of the display board is a common mess in some of the existing rooms, containing of PM2.5, pollen, allergens, dust, fungi, smoke, formaldehyde and benzene. All these things are harm of our bodies all the time. The mess is filtered through the filter core and then filtrated through the linen or non-woven fabrics. The linen or non-woven fabrics are easy to absorb the water and easy to dry, adding incense and humidification directly to the cloth cover. The fresh air spread into the room through the cloth cover with the fragrance and water. The whole machine works by using a fan at the bottom to suck the dirty air in, through the triple purification and finally filtered through the linen in figure 1.

4.1.2. The Appearance Design. The appearance make persons be close to nature indoors, and feel new and fresh. The product main material which are as far as possible environmental and recycled are select ed for linen and stainless steel. These can serve as the adornment and furniture.

4.1.3. The Structure Design. The whole is composed of the universal wheel, the fan, the bracket, the filter core, the lamp and the cloth cover in figure 2.
4.2 The Interface Design
A APP is designed, which monitors fully intelligently the quality of the air indoor, and the data is collected automatically, and analyzes by the powerful software, timely get the analysis conclusions and command execution device to make appropriate decisions. It can take different automatic control plans and implementations, according to the air pollution type and pollution levels indoor, respectively.

a. Equipped with two control methods: the wireless remote control and the keyboard control. Users can choose to use them at will.

b. A variety of operating modes for the user to select such as the intelligent control and manual setting control meet the needs of children, the older who are easy to operate, and take care of special user's personalized need.

c. The display function can show the air temperature, humidity, freshness and cleanliness, which the indoor air quality status are well known.

d. With functions of the self-diagnosis and prompt Settings, the human-machine interactive dialog easily implement on the control interface. When there is abnormal product running state, the computer will automatically show the problem, and sing to remind users to timely treatment.
In the main interface in Figure 3, there are local weather conditions. If there are several air purifiers in the home, they can be displayed in the same account. The air qualities of each region are tested and recommendations are given at the same time. The interface of the each region consist of the current state, the history record, the time switch. The current state is to tell the user whether to need to open air purification machine and the history can be found such as the daily basis, statistical results, and then the diagrams are draw. According to the analysis result, the timer switch will start. It can be activated before getting home and when the child the old are at home. The wind direction can also be adjusted after opening, and the phone can be controlled remotely.

5. The Application Effect
It is proved that the air purifier can provide healthy air for a family (about 80 to 160 square meters), and the power consumption is only about 50W in the normal operation. In the case of maintaining long-term cleaning, the power consumption is only about 30W. The daily cost of electricity is about 25RMB per month. Each family usually only chooses to install one, and any room can be easily converted.

This air purifier is eco-friendly. The filter element and the cloth cover can be replaced at will and it is very convenient of cleaning the cloth cover regularly. At the same time, the APP is designed to connect with the mobile phone to realize remote control and facilitate people’s life.

6. The Conclusion and Extension
The vertical intelligent healthy air machine can effectively remove the harmful gas and adsorb the suspended particles in the air, especially the various bacteria and viruses. The vertical healthy air purifier can produce the fresh air. Pure and fresh air is not only good for your physical and mental health, but it can also help relieve stress and relax.

The vertical intelligent health air machine, which fully adopts the existing patent of air purification core technology, integrates smart home modules into the works. At the same time, in the intelligent design of the product, the scientific planning intelligent interaction process, and the emotional design and the user experience are fully considered.

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