"Carbon Neutral" Interactive Science Art Installation

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Abstract. Art Interactive Science Installation is a product of the combination of contemporary art and technology. It is an installation designed to create a connection between scientific knowledge and the audience. With the increasing human activities, environmental issues have become one of the most concerned topics: global warming, rising temperatures, desertification of the land, acidification of the oceans…… And the destruction of the natural environment, all these phenomena tell us that reducing carbon emissions is an urgent obligation. Against this backdrop, "carbon neutrality" has been proposed and is gradually being promoted. This has led to the creation of an interactive science installation based on "carbon neutral" art. "The Carbon Neutral installation is based on the Arduino development version, which uses a programming method to enable the audience to interact with the art visual design. The installation is designed to convey carbon-neutral knowledge and concepts to the audience through a variety of displays, thereby raising public awareness of the need to cherish the ecological environment.

Keywords: interactive installation · carbon neutrality · science and technology · Arduino

1 Introduction

1.1 Artistic Science Interactive Installation

The interactive art and science installation is an innovative way of combining art and technology, allowing the audience to explore scientific and technological knowledge more efficiently and vividly when interacting with the installation. At the same time, a suitable interactive process enhances the fun of the audience's experience in the process of receiving science popularisation, which effectively expands the audience of the art installation. These installations are usually displayed at art exhibitions, science and technology museums, cultural festivals, and other venues, to allow the audience to experience and understand art and technology more personally.

1.2 The Origins of Art Science Interactive Installations

The origins of art and science interactive installations can be traced back to the late 1990s when the integration of technology and art was gaining increasing attention. [4] As digital technology, virtual reality, computer graphics, and other technologies continued to develop, artists began to apply these technologies to their creations, creating a series of interactive, multimedia works that became known as 'new media art'[5].

At the same time, more and more science and technology museums and galleries are taking an interest in these new art forms and incorporating them into their own exhibitions and cultural events. These exhibitions and events not only satisfy the audience's demand for art and technology but also widely promote the application and development of art as an art form in the form of art-science interactive installations [6].

2 "Carbon Neutral" Thematic Context and Interaction Design Links

2.1 The Significance of "Carbon Neutrality" in Science

With climate change and environmental pollution becoming increasingly serious, the reduction of carbon emissions has become a global concern. In this context, the concept of 'carbon neutrality' is gaining increasing attention. Carbon neutrality refers to the process of offsetting an individual's, organizations, or country's carbon emissions against their impact on the environment through a variety of actions such as reduction, offsetting, or removal. The importance of carbon neutrality is being promoted through public awareness and action:

Popularisation activities can make the public aware of the impact of their production and lifestyle on the environment, so that they become aware of their environmental responsibilities, take the initiative to adopt measures to reduce carbon emissions, and choose more environmentally friendly consumption patterns. For example, many households are beginning to conserve water and reduce food waste pushing governments and businesses to adopt stricter environmental policies: Public outcry for environmental protection can force governments and businesses to adopt stricter environmental policies and measures, thereby promoting carbon reduction and carbon neutrality Promoting interdisciplinary collaboration: Carbon neutrality is an interdisciplinary issue involving many fields such as earth science, environmental science, and economics. Science popularisation activities can facilitate knowledge exchange between various disciplinary fields, promote interdisciplinary cooperation, seek more effective ways and technologies to reduce carbon emissions and provide a more scientific basis and support for achieving the goal of carbon neutrality.

And today it has been proven that art science popularisation raises awareness and concerns about environmental issues. According to research, compared to ordinary forms of science popularisation, art science popularisation is more likely to attract public interest and attention, helping to promote discussion and reflection on topics related to environmental protection. For example, in some cities, artists have transformed urban waste into artworks to demonstrate the impact of waste pollution on the environment in a special way, thus raising public awareness of waste separation and environmental protection.

3   Current Status of Research on Interactive Devices

To promote the improvement of the environment, artists in many countries and regions are actively engaged in related scientific activities to promote the concept and meaning of carbon neutrality to the public, the following are some of the more representative works in related fields:

1. 'Wrapping the Coastline' [1] From Brazilian artists Christo and Jenny Crowder, this installation of dozens of kilometers of fiberglass rope and hundreds of thousands of square meters of preserved fabric tied to a small mountain peak in Australia is a large-scale work that also conveys a striking visual impact. The concept of the work is a combination of nature, technology, and sustainability, expressing a sense of reverence for nature and a call for environmental protection.
2. 'Masai Mara' [2]: This installation was created by Liang Mingyu, a clothing designer from Chongqing, China. It uses hundreds of discarded jeans as the material for the work, which is shaped like a giant wild African elephant mother and child, close to the size of a real elephant. The title of the work is in contrast to the meaning of the Masai Mara National Reserve itself, and it is hoped that this work will call for public attention to the conservation of the natural environment and ecology.
3. 'Luminous Nature' [3]: This work, designed by the artist Dan Rothgaard, uses biotechnology to enable interaction through living luminous algae. The single-celled luminous algae, which can glow when touched with care, is not only illuminating but also highly artistic. The interactive installation uses biotechnology to express the concept of environmental protection. When visitors interact with this work, it emits a lifelike light effect.
4. Artistic science has created a favorable social climate for environmental issues. It raises awareness and concern and promotes policy and action.

4   Design and Implementation of the Device

4.1   Design Orientation

Compared to the above designs, the interactive science installations focus more on the combination of science and art in the installation and have a better internal logic of the installation. The design needs to be more precise in terms of pain points and improving the user experience.

The installation aims to create low-carbon awareness by combining digital technology with interactive language and using artistic techniques to give users a vivid visual representation of our carbon footprint.

The design starts from the concept of carbon neutrality, which means that carbon emissions need to be equal to carbon absorption and that the indirect and direct emissions of carbon dioxide from anthropogenic activities in a given area over a certain time should be offset by the carbon dioxide absorbed through afforestation, for example, to achieve 'net zero' carbon dioxide emissions. Our daily carbon emissions can be calculated from people's daily carbon footprints. A carbon footprint is a representation of a person's or group's 'carbon consumption', the impact that a person's energy awareness and behavior has on the natural world. Carbon emissions are present in every corner of people's lives,

in food, clothing, housing, and transport. Through visual and interactive design, the visualization of the process of carbon pollution before, after, and neutralization and the changes in carbon emissions, the scenes and activities of people's lives are presented. The design is a visual representation of the process of carbon pollution before and after pollution, the changes in carbon emissions, and the activities of people.

4.2 Visual Design

The main focus is on the visual representation of carbon footprints and emissions through the design of IP images and scene animations. The carbon footprint is a part of our lives, food, clothing, housing, and transport. In the production of the scenes, we equate carbon emissions with building carbon emissions plus transport carbon emissions, plus personal carbon dose minus green space carbon sinks, based on which the scene elements are created including buildings, transport, human activities, and green space carbon sinks, and based on these scenes we create animated images.

The inclusion of the IP character design in the production of the scenes allowed the carbon footprint to become more tangible. The IP character, Carbon, is an irregular round shape with an anthropomorphic expression and a grey hue, which allows it to overlap with the image of carbon pollution that people perceive and evokes an emotional resonance with users. Carbon Carbon is the embodiment of a carbon footprint, growing with people's carbon footprint emissions, and users can intuitively feel the visual difference in its size and the impact it brings to the environment. The second image is designed to represent the user, taking a predominantly yellow color palette, again using anthropomorphic forms and expressions to enhance the intuitive color impact while making the image more design-led. It acts as a figure in the image and plays a significant role in human behavior concerning the carbon cycle. Through the character's different actions in the image, the user can be taught where carbon emissions come from and how to reduce carbon and go green as an individual.

4.3 Interaction Design

The device will use a desktop computer, an Arduino development board, a CO2 concentration sensor, and a $0.96''$ OLED screen as the main hardware support for the interaction design. The key feature of the interaction design is the implementation of a sensor to determine the carbon concentration and switch the control of the OLED screen. The device uses a carbon dioxide concentration sensor to sense the internal and external pressure and a gas-sensitive material to sense the release of electrons to change the resistive signal conversion and thus make the screen jump. In terms of data judgment, a blowing experiment was carried out: the CO2 concentration sensor was placed 20 cm away from the person to carry out a blowing test to observe the change in data under different conditions, based on the data obtained from the blowing experiment, the data were grouped and divided to set the trigger conditions for the LED screen switch. The audience to the nitrogen dioxide carbon dioxide concentration sensor blowing sensor feel the change in the surrounding carbon dioxide concentration, the change in concentration is set to three gradients: 400 ppm–600 ppm is the first gradient to show the normal state; 600 ppm–1400 ppm is the second gradient and small mouth blowing state; 1400

ppm–3600 ppm is the third gradient only largemouth blowing state. To avoid the change of detection data, too fast to cause the screen to jump too fast set each frame, to at least 5 s, to ensure the best viewing experience.

5 Artistic Presentation and Design Innovation

5.1 Interaction Scenario Design

The drawing design of the interaction scenes is divided into three stages, before and after contamination, based on the design of the scenes combined with the interaction process.

Before pollution: the main constituent elements, there are green plants, the city, solar energy, and green travel. The picture has a yellow-green hue, with a high degree of saturation and a relatively bright color scheme giving the picture, a relaxed and lively atmosphere. Through the bright color scheme and people's green and healthy way of traveling, it shows the appearance of people's ideal green home, when carbon emissions and absorption reach a balanced state and the volume of carbon talk only takes up a small part of the picture;

In pollution: the main constituent elements, there is a haze descending, fuel cars, and a small amount of vegetation taking up only a small part of the picture. The tone of the picture is light grey, and the brightness is relatively high, presenting the process of pollution, the environment is not completely seriously affected, as people exhale carbon dioxide concentration increases, the picture will also switch to the corresponding scene when the concentration reaches 1200 ppm is a small amount of haze at this time, the volume of carbon becomes larger, the vegetation reduces the color, the brightness decreases, showing is people with the carbon emissions of the body high urban ecology has found to have suffered some damage;

After pollution: the main constituent elements, there is urban pollution goods traffic haze weather, pollution sources emissions screen with grey and black tones, color brightness is low, the overall atmosphere of the picture is depressing, through the carbon dioxide concentration sensor detected too high carbon dioxide concentration animation jump to this scene, the volume of carbon continues to become larger. The city is polluted with a large amount of transport pollution emissions, resulting in the complete disappearance of vegetation. Through a low saturation and low brightness color scheme, the city is shown to be polluted and darkened, with the thermometer on the left reaching a peak warning of the seriousness of the impact on the city and natural ecological pollution through high carbon emissions.

5.2 Design Presentation

The interaction guide design divides the audience's interactive behavior into three stages of design, the first stage audience viewers pick up the carbon dioxide concentration sensor blowing mouth, in this interaction stage the screen state is presented as a pre-pollution scene, the scene is bright, symbolizing the healthy development of the ecological environment, the second stage of the user blowing on the carbon dioxide concentration sensor receives feedback against the set three carbon dioxide concentration gradient.

The program control controls the LED screen to switch the transformed scene screen state according to the sensor received to different concentrations and presented as a different picture scene in pollution and after pollution, the screen presented as a hazy city in carbon pollution, symbolizing ecological destruction; the third stage the audience stop blowing into the mouthpiece screen state, presented after the end of the guide screen, symbolizing the picture after carbon neutral, calling on the public Join in the practice of carbon reduction.

6   Summary

The "Carbon Neutral Science and Technology Device" combines visual design and interactive design to create a "Carbon Carbon" IP to visualize people's life scenes and create a visual carbon footprint, using data and images to visually represent carbon emissions, calling for more people to pay attention to the issue of carbon neutrality and The project is a visualization of carbon footprints, with data and images visualizing carbon emissions.

We used programming tools to combine an Arduino development version, a CO2 concentration sensor, an LED screen, and a desktop computer to provide technical support for the interactive process. This paper proposes a new way of combining art and technology, which is a major innovative practice in this field. On the one hand, the art field will become more colorful when infused with technical elements, and on the other hand, the science and technology after artistic treatment will make the science popularisation process more interesting for a broader audience, and it is believed that this art-tech combination will contribute to the diversified development of society.

The diversity of development.

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