Project Breathe

A virtual reality demonstration of Climate Action and a possible solution to mitigate the carbon dioxide in atmosphere

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Abstract

In recent years, climate change has become a global concern as evidence grows that climate change is resulting in serious impacts on global ecosystems, economies, and human health. Project Breathe is a Virtual Reality (VR) project aimed to showcase the negative effects of CO2 emissions and propose a solution: RACTO, an artificial photosynthesis device; to help mitigate the impact by reducing CO2 levels in the air. Through the recreation of three zones, users will be able to experience the impact of air pollution and climate change in these zones. The project aims to foster public awareness of their carbon footprint, the cruciality of climate change and environmental protection, and inspire individuals to take concrete actions in contributing towards a sustainable future for the planet.

CCS CONCEPTS: Human Centered Computing, Environmental Science and Engineering, Human computer interaction

Additional Keywords and Phrases: Virtual reality, Climate change, Artificial photosynthesis, Carbon dioxide, Greenhouse gas emissions.

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1 Introduction

Climate change has become one of the most important global challenges. As climate change worsens, various regions worldwide are experiencing serious problems such as temperature rise, extreme weather, sea

level rise, and ecosystem collapse. In 2015, the United Nations General Assembly initiated the 17 Sustainable Development Goal, including Goal 13, **Climate Action**, which has the objective of enhancing efforts to address climate change. According to scientists, if no action is taken to mitigate the effects of climate change, more severe natural disasters, water shortages, food security issues, and reduced biodiversity will occur in the coming decades. [1]

1.1 Research

Greenhouse gas emissions are one of the main causes of climate change. Through various research, greenhouse gas emissions have negative effects that cause global warming and ocean acidification. The average temperature anomaly in 2022 is 0.89°C higher than the year between 1951 to 1980 and the acidity level of the ocean is rising 30 percent higher only in the past 200 years compared to the last 50 million years. These changes result in abnormal weather patterns, sea level rise, and extinction of sea creatures due to changes in pH levels. [2] However, this is mainly caused by the rapid increase in the level of Carbon dioxide in the atmosphere. Carbon dioxide, also known as the primary greenhouse gas, has risen from 280 ppm in preindustrial times to 410 ppm nowadays. This result is inseparable from human activities, such as industrial production, transportation, and agricultural consumption, which produce large amounts of greenhouse gas emissions that directly affect global climate change. In addition to carbon dioxide, other greenhouse gasses also have a significant impact on climate change, including methane, nitrous oxide, and freon. These gasses might not last in the atmosphere for a long period of time but have a much higher intensity of greenhouse effect than carbon dioxide. [3]

1.2 Design workshop

Based on our research findings, we initially started with the idea of creating a VR project that would demonstrate several extreme weathers caused by everyday choices made by individuals on Earth. The goal was to raise people's awareness of the consequences of their daily actions, though many everyday behaviors and choices may seem insignificant but all those contribute to climate change.

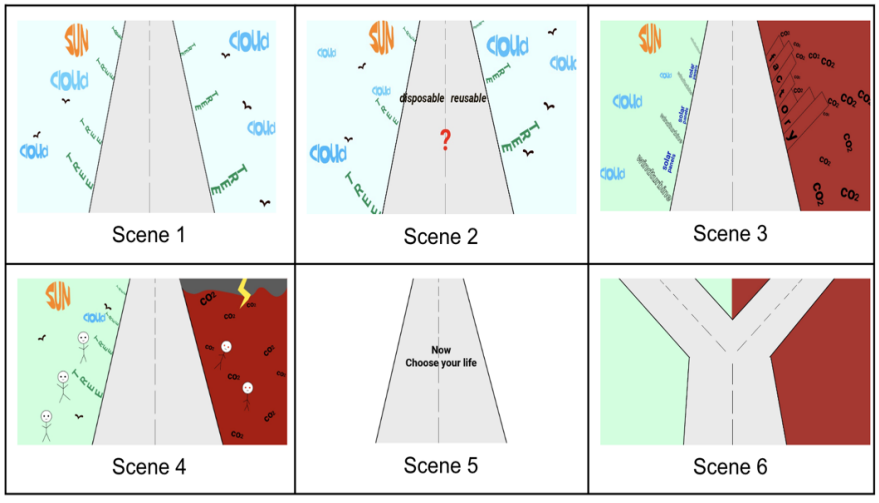

Figure 1 Original Storyboard

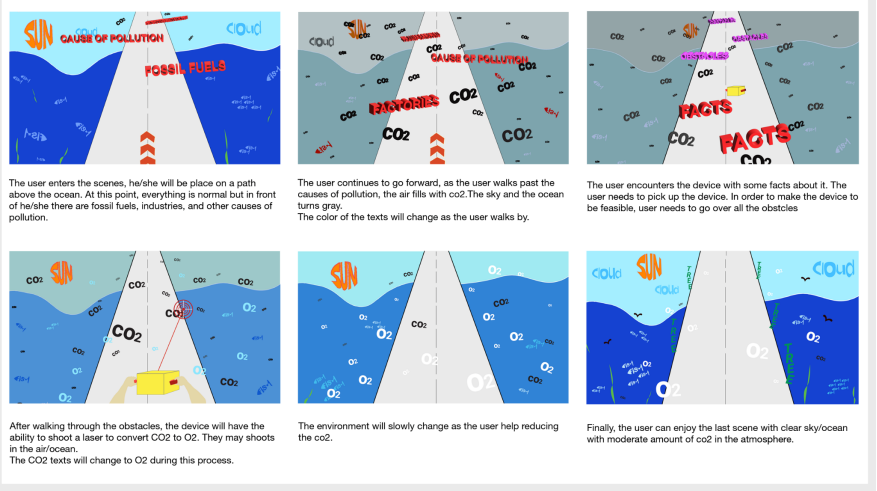

Figure 2 revised storyboard

We soon recognized the inadequacy of the design because it did not include a solution that would effectively address the problem of climate change. With this in mind, we decided to focus on greenhouse gasses and settled on the concept of reducing the level of carbon dioxide in the atmosphere. Meanwhile, one of our group members was inspired by some articles and studies that suggested that water and other substances could be used to convert carbon dioxide into oxygen. For instance, plants produce oxygen through photosynthesis, which uses sunlight and water to absorb carbon dioxide then release oxygen. Additionally, the MOXIE project, supported by NASA, is exploring the possibility of converting carbon dioxide on Mars into oxygen. [4] We thought about combining these technologies and creating a device capable of converting atmospheric carbon dioxide into oxygen for use on Earth's surface. Through more research, we had found out the exploration of theories and devices in this field has been ongoing, a team from LiSA lab at Berkeley Lab have been designed a device by using artificial photosynthesis material to degrade Co2. [5]

2 Developing with unity

We get into the development process, we have made several revisions to our storyboard to enhance users' ability to comprehend and experience the environmental harm caused by CO2. The final design has divided the pathway into three parts: Causes of Co2(exhaust fuel, wildfire, factories), Device of Artificial Photosynthesis, Land of Peace. .As Our team has never worked with UNity3d or C# scripting. Learning a new language is always challenging but to overcome those challenges we also faced so many difficulties and we have to work closely with our designer and make the project look aesthetic and also with a lot of functions that should demonstrate the use of the device. The main challenge we faced was As we all know its almost completely impossible to eliminate all the co2 that's in the atmosphere and we brainstormed our ideas together and designed a perfect way to include those limitations of our project and included them in an interactive way so the use will know what could be the limiting factors of the device and our project.

1.3 Causes of CO2

The first scene of the VR project is composed of three sectors. The user will begin by walking through a pile of O2, followed by the zones of exhaust fuel, wildfire, and factories, each accompanied by various visual and auditory effects such as black smoke, flames, factory machinery noise, and the sound of people struggling to breathe. These effects are designed to draw users' attention and prompt them to contemplate climate change.

2.1.1 Exhaust fuel

Exhaust fuel is the exhaust gas from cars or other engines that contains residues of incompletely burned fuel, which is one of the main culprits in the production of exhaust gasses. Since the industrial revolution, new fuels have injected new capabilities into humanity but also brought many negative impacts to the environment. These negative impacts eventually affect the health of humans as well as other living things through nature's cycles.

The virtual reality project presents exhaust fuel as a parking lot with different kinds of transportation, where users can experience the presence of exhaust gas upon entering the scene. Users will see trace amount of CO2 in the air.

2.1.2 Wildfire

Wildfires are not intentionally planned fires that burn in natural areas such as forests, grasslands, or prairies. Wildfires are caused by factors such as lightning, high temperatures as well as dry weather conditions, and many times wildfires can also be caused by inconsiderate human activity. Wildfires can destroy large areas of plant and wildlife habitat. In addition, wildfire smoke is a mixture of air pollutants, of which particulate matter is a major public health threat.

The virtual reality project presents wildfire as a burning forest, where users will perceive the sound of flames and witness smoke rising from the wildfire, providing them with an understanding of the impact of wildfire on human health. The amount of CO2 starts to increase in the air.

2.1.3 Factories

Factories are essential for producing goods and are an integral part of modern industrialized societies. They fulfill human needs and contribute significantly to economic development. However, the manufacturing process in many factories releases substantial quantities of detrimental gasses and particulate matter. These substances collect in the atmosphere and form haze, which not only affects air quality, but also has an impact on the health of humans, animals, and plants.

In the virtual reality project, the factory is presented as a smoggy, polluted area with smog and pollution, evoking feelings of discomfort and despair among the users. The amount of CO2 continues to increase and grows in size until the atmosphere and the user path is filled with Co2 so the user can't move not even a single step forward and gets the feeling that he is totally covered with co2 and suffocating. which is meant to show the user how can pollution pile up and suffocate the people on the earth

1.4 Device of Artificial Photosynthesis – RACTO

We named the device RACTO, or Revitalizing the Air with CO2-to-O2 Conversion. This device is functioning with artificial photosynthesis, using sunlight and humidity to convert CO2 to O2. we got inspired by the NASA MOXIE project To produce oxygen from the Martian carbon-dioxide atmosphere

CO2 + Sunlight + Humidity(moisture) -> Oxygen and glucose

Figure 3 RACTO

Limitations and challenges

Efficiency of light capture and conversion - One major challenge in developing artificial photosynthesis is achieving high efficiency in capturing and converting sunlight into usable energy. This requires the development of new materials and technologies that can efficiently capture light and efficiently convert it into chemical energy. [6]

Cost-effective catalysts - Another major challenge is finding cost-effective and stable catalysts for the reaction. The catalysts must be able to facilitate the chemical reaction at a reasonable rate and without requiring too much energy input. [7]

Integration with existing infrastructure - Finally, integrating artificial photosynthesis with existing energy infrastructure presents a significant challenge. This requires the development of new technologies and infrastructure to transport, store, and distribute the energy produced by artificial photosynthesis. [8]

1.5 Land of Peace

Upon successfully utilizing RACTO, an artificial photosynthesis device the co2 in the atmosphere will be destroyed and will remove all CO2 while generating O2 to replace it in the atmosphere. This place symbolizes a beautiful and livable environment unpolluted by greenhouse gasses, where user can relish the splendor of nature and breathe clean air.

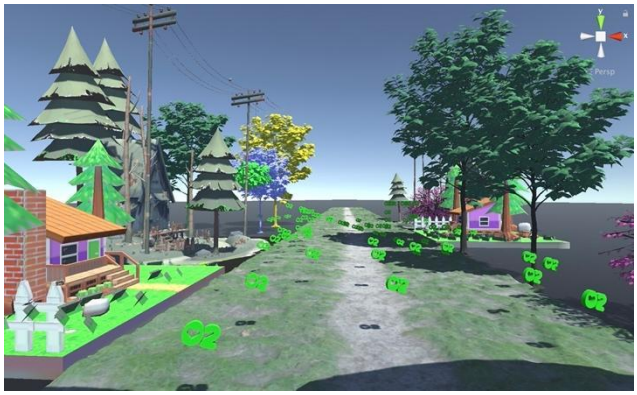

Figure 4 Land of Peace

2. Conclusion

The paper discusses Project Breathe, a Virtual Reality (VR) project aimed at showcasing the negative effects of CO2 emissions and proposing a solution to mitigate the impact by reducing CO2 levels in the air. The project aims to foster public awareness of their carbon footprint, the importance of climate change and environmental protection, and inspire individuals to take concrete actions in contributing towards a sustainable future for the planet. The paper discusses the issue of climate change and greenhouse gas emissions, the design process of the VR project, and the proposed solution, RACTO, an artificial photosynthesis device. We also discuss ongoing research in the field of converting atmospheric carbon dioxide into oxygen. The paper provides insight into the importance of addressing climate change and the role of technology in finding solutions**.**

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