



NASA INTERNATIONAL SPACEAPPS CHALLENGE 2022



URANIA

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CHALLENGE

TAKE FLIGHT: MAKING THE MOST OF NASA'S AIRBORNE DATA

1. INTRODUCTION

Climate change is intense, changes in temperature and climate patterns have been increasingly evident over the years. Climate change affects not only temperature but also affects health, the environment, food production, housing safety, and work. Since the Industrial Revolution, human actions have been an important driver of climate change, especially in the extraction, production, and burning of fossil fuels. The consequent emission of gases intensifies the greenhouse effect, a natural protection of the planet, generating global warming extremely harmful to life on Earth.

Methane gas (CH_4) is a tetrahedral and apolar molecule hydrocarbon. Under normal conditions, methane is colorless, odorless, flammable, and explosive in the presence of ignition. Being the main component of natural gas, methane is generated in agriculture, mining, fuel production, biomass burning, landfills, hydroelectric plants, and reservoirs. Increases in methane levels can be the result of industrial leaks and environmental neglect. In addition, groundwater is susceptible to

methane contamination and the accumulation of underground gas can result in explosions.

Exposure to high concentrations of methane can lead to respiratory failure, loss of consciousness, vertigo, drowsiness, asphyxia, cardiac arrest, and damage to the nervous system. Methane accounts for about 20% of the greenhouse effect. Even though its concentration is low in the atmosphere, the gas has an 80 times greater capacity to retain heat. Therefore, excessive release of methane causes an increase in the planet's temperature. According to an analysis made, available by the United Nations (UN), methane appears to be the second most important gas in the intensification of the greenhouse effect.

In 2015, the Paris Agreement was signed by several countries at the 21st Conference of the Parties (COP21) and aimed to reduce greenhouse gas emissions to promote sustainable development and keep global warming below 2°C. Held in Scotland, the 2021 United Nations Climate Change Conference (COP-26) presented the Global Methane Commitment. The target has been signed by more than 100 countries and aims to reduce emissions by 30% by 2030, aiming at limiting global warming. Even so, in 2022, the U.S. National Oceanic and Atmospheric Administration (NOAA) showed that methane concentrations in the atmosphere exceeded 1,900 parts per billion in 2021.

Monitoring methane concentrations is essential to alert the population and direct government prevention actions to the leak. In addition, raising awareness among the world's population about the risks of high concentrations of methane gas for human and environmental health, warming and the future of the planet is a key tool to stimulate the participation and collaboration of the local community in the search for actions that minimize the amplification of climate change.

2. PROTOTYPE

The Urania application, which will be completely free and accessible, aims to inform and raise awareness of the population through records relevant to the emission of Methane (CH₄). It will collect data and images from NASA and ASC-CSA satellites to identify high levels of methane in the soil, especially in regions near landfills, flooded areas, and oil-related companies.

The real-time mapping that will be carried out allows any type of person to monitor the emission and reduction rates of gas in the atmosphere. On the map, you

can perform filters by region so that records can be delimited and known to everyone. In addition, the application contains a dashboard, completely updated, where it will present graphs and tables that demonstrate all variations and records on gas emissions, climate change caused by this reason, temperature variations, and radiation indexes. Urania also has informative screens, where it presents its users with the greatest risks of gas emissions, as well as a tab with the latest news on the subject.

It has an exclusive alert, triggered by the high variations in the emission process, as well as in the sudden and/or accentuated climatic variations. And in order to help the population and governments and authorities of each region, there is a predictive system, controlled by artificial intelligence, capable of simulating various changes in data and reaching assertive conclusions, through efficient machine learning. These conclusions will be transformed into useful information, disclosing possible new climate change that could affect a particular area in a mild, moderate, and severe manner.

3. DASHBOARD

The dashboard, also in the web version, will use open data sources from space agencies, such as climate change and gas emission levels, in order to identify places with high levels of methane emission, a gas that contributes to the greenhouse effect and is completely harmful to the atmosphere. The dashboard will present graphs that allow the measurement of the collected data and provide analysis for the machine learning present in the system, collaborating with the created artificial intelligence, allowing the identification of possible changes for the future, and alerting the population and authorities of each region.

We will use new technologies with many opportunities for updates and expansions to develop our solution. We want it to be scalable to receive and handle more data in real-time. For this, we will use the following technologies: NodeJS, React Native, and TypeScript for development, in addition to using PostgreSQL, to create a relational database structure, MongoDB, to help us in non-relational structures, and Redis, to compose the structuring from our base. We will also have the help of APIs to collect data, mainly related to climate change, gas emissions, and global warming, providing filtered and useful information for Urania.



(Figure 1: App template. Font: Authors)

4. LINK TO PROJECT DEMO

“URANIA APP” is available at <https://youtu.be/pwtPHnKw0zg>

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