# Team UDUPI

Space Apps Challenge 2024

## Project Title:

Mapping Human-caused and Natural Greenhouse Gas Emissions Using Satellite and Model-Based Datasets

(Insert Team Logo here)

# Introduction

## Problem Statement:

Human-caused (anthropogenic) greenhouse gas emissions, along with natural systems that produce and absorb greenhouse gases, interplay in a complex manner to contribute to global climate change. Climate change is one of the most pressing issues facing the world today, with the Earth's rising temperatures linked to increasing greenhouse gas concentrations. In this project, Team UDUPI aims to use a combination of satellite and ground-based data to map these emissions in an effort to better understand how they contribute to global warming.

## Background:

Greenhouse gases, primarily carbon dioxide (CO₂) and methane (CH₄), trap heat in the atmosphere and are a significant driver of the Earth’s rising temperatures. Human activities, such as industrialization, deforestation, and the burning of fossil fuels, are key contributors to elevated greenhouse gas levels. At the same time, natural sources and sinks—such as forests, oceans, and wetlands—play an essential role in maintaining the balance of gases in the atmosphere.

Understanding the delicate balance between anthropogenic emissions and natural processes is crucial for creating effective policies that can mitigate the impacts of climate change. In this challenge, we use advanced technologies, including satellites and machine learning models, to map and analyze these emissions.

# Data Collection and Methodology

To address the problem of mapping both anthropogenic and natural greenhouse gas emissions, the following methodology will be used:

## 1. CanSat Deployment

A CanSat is a miniaturized satellite that can be deployed via a balloon or drone to collect atmospheric data. For this project, we will equip the CanSat with sensors that can measure the concentration of key greenhouse gases, such as CO₂ and CH₄. The data collected will provide ground-level insights into emissions sources.

## 2. Satellite Data Integration

In addition to ground-level data, we will utilize satellite datasets. Satellites, such as NASA’s Orbiting Carbon Observatory-2 (OCO-2), provide large-scale observations of greenhouse gas concentrations across the globe. This data will be integrated with our CanSat readings to create a more complete picture of emissions.

## 3. AI Model Training

An AI model will be developed to analyze the data collected from both the CanSat and satellite sources. Using machine learning techniques, the model will distinguish between emissions from human activities (such as industrial emissions) and those from natural sources (such as forest fires and volcanic activity).

# Solution Overview

The solution is divided into several key phases that will be followed to ensure that the project delivers accurate and actionable insights. These phases include data collection, data preprocessing, model training, and model deployment.

## Phase 1: Data Collection

In the first phase, we will deploy the CanSat to collect ground-level data, while also retrieving satellite data from established sources such as NASA and Copernicus. Data will be collected over multiple regions, focusing on both industrial areas and natural environments.

## Phase 2: Data Preprocessing

Once the data is collected, it will be cleaned and preprocessed. This involves filtering out noise and ensuring that the data is accurate. Normalization techniques will be applied to ensure that data from different sources can be compared on the same scale.

## Phase 3: AI Model Training

In this phase, machine learning algorithms will be used to train the AI model. The model will be designed to identify patterns in the data, such as spikes in greenhouse gas concentrations. It will also be capable of distinguishing between human-caused and natural emissions by analyzing specific characteristics in the data.

## Phase 4: Model Deployment

Once the AI model has been trained, it will be deployed to run in real-time, continuously monitoring emissions and providing updates to authorities. The system will be capable of flagging areas where emissions are unusually high, prompting further investigation.

# Feasibility and Viability

The technical and financial feasibility of the project is strong, given the use of low-cost CanSats and the availability of satellite data from open-source platforms. AI technologies and cloud computing resources will also be utilized to ensure that the project can scale efficiently.

## Budget Considerations:

1. CanSat deployment costs: $1,000 per unit.2. AI model development: $5,000 for initial development.3. Cloud storage and computing: $2,000 annually for data storage and processing.

## Scalability:

As the project grows, more CanSats can be deployed in different regions to collect data over a wider area. The AI model can be retrained on a regular basis, improving its accuracy over time. This ensures that the project can be scaled to monitor emissions on a global scale.

# Conclusion

Team UDUPI's project offers a scalable, AI-driven solution to the problem of distinguishing between human-caused and natural greenhouse gas emissions. By combining data from ground-based sensors and satellite observations, we are able to provide a comprehensive view of emissions sources, enabling policymakers to make informed decisions about climate change mitigation efforts.