AI for Sustainable Development — Predicting CO_2 Emissions (SDG 13: Climate Action)

1. SDG Problem Addressed

This project supports SDG 13: Climate Action, which aims to take urgent action to combat climate change and its impacts.

Rising carbon dioxide (CO_2) emissions are a major cause of global warming, leading to environmental degradation, extreme weather, and biodiversity loss. The goal of this project is to build a machine learning model capable of predicting future CO_2 emission trends for different countries, helping policymakers make data-driven decisions toward sustainability.

2. Machine Learning Approach

A Supervised Learning model was implemented - specifically, a Random Forest Regressor - to predict CO_2 emissions based on historical data from various countries.

Algorithm Used: Random Forest Regressor

Dataset: CO_2 Emissions by Country (from Kaggle)

Features: Year and Country (encoded numerically)

Target: CO_2 emissions (kilotons)

The model was trained and evaluated to determine its ability to generalize to unseen data, particularly focusing on Kenya as a case study.

3. Results

Model Accuracy (R^2 Score): 0.9983

Mean Absolute Error (MAE): 23,426 kt

Kenya R^2 Score: 0.7978

The high R^2 value indicates that the model can effectively capture emission trends across different nations. For Kenya, the model successfully forecasts a gradual increase in CO_2 emissions, consistent with the country's growing industrial and energy consumption patterns.

4. Ethical and Social Reflection

Bias in Data: Some countries may have incomplete or inconsistent CO_2 data reporting, which can introduce bias and affect prediction accuracy. High-income nations typically have more reliable datasets, which may skew global comparisons.

Fairness and Sustainability: The project promotes fairness by focusing on data-driven climate policy, encouraging transparency and accountability in emissions reporting.

By forecasting future CO_2 trends, this model empowers sustainable planning, supports renewable energy initiatives, and raises awareness of the environmental impact of industrial growth.

Conclusion

This project demonstrates how AI and machine learning can play a critical role in advancing sustainability and combating climate change. Predictive modelling provides actionable insights that can guide national policies toward a greener, more sustainable future.