INDIANA UNIVERSITY
BLOOMINGTON

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1. Project Name

Analyzing Long-Term Climate Trends: Investigating the Evolution of Temperature, Humidity, and Wind Speed Across Regions.

2. Team Members

Team Member	Project Type
Pasan Kamburugamuwa	Individual Project

3. Project Objectives

This project aims to analyze long-term climate trends by examining key environmental factors such as temperature, humidity, and wind speed. By identifying patterns and changes over time, I seek to understand the impact of climate change on different regions and ecosystems.

As of now, climate change remains a widely debated topic, with some viewing it as the greatest threat of our time, while others question its scientific basis. Analyzing long-term climate trends requires careful handling of historical data due to variations in measurement methods over time.

Early temperature records relied on mercury thermometers, where changes in observation times could impact accuracy. The mid-20th century saw weather station relocations due to airport construction, while the 1980s introduced electronic thermometers, which may have introduced a cooling bias.

3. Project Description

3.a Usefulness

This time series application is crucial for understanding long-term climate trends by analyzing temperature, humidity, and wind speed variations over time. Climate change is a pressing global issue, and identifying patterns in historical climate data can help predict future changes, inform policy decisions, and aid in environmental planning. By leveraging a comprehensive dataset from Berkeley Earth, this project provides a data-driven approach to understanding climate evolution.

3.b Are there similar applications

Yes, several organizations and research institutions have developed similar climate monitoring and forecasting applications:

1. **NASA's GISTEMP (Goddard Institute for Space Studies Temperature Analysis)** – Provides global temperature anomaly data.
2. **NOAA's MLOST (Merged Land-Ocean Surface Temperature Analysis)** – Focuses on land and ocean surface temperature trends.
3. **UK's HadCRUT (Hadley Centre Climate Research Unit Temperature Dataset)** – Monitors global surface temperatures.
4. **Berkeley Earth's Climate Data Platform** – Aggregates temperature data from multiple sources

3.c How is this application different?

More Granular Analysis: Unlike global-level studies, this project aims to analyze climate factors at a **regional level**, allowing for localized insights into climate change.

Multi-Factor Approach: While most applications focus primarily on temperature trends, this project incorporates humidity and wind speed to provide a more holistic view of climate change.

Customizable Insights: The ability to slice data by region, time period, and environmental factors makes this application more flexible for different research needs.

3.d How is this application different?

This application is designed to benefit multiple stakeholders,

Climate Scientists & Researchers: To analyze long-term climate patterns and validate climate models.

Government Agencies & Policymakers: To make informed decisions on environmental policies and climate action strategies.

Environmental Organizations: To advocate for climate change mitigation and adaptation based on real data.

Agricultural & Industrial Sectors: To assess climate risks and adapt business strategies to changing environmental conditions.

General Public & Educators: To increase awareness of climate trends and educate communities on climate change impacts.

4. Dataset

The dataset used for this project comes from Berkeley Earth, a research organization affiliated with Lawrence Berkeley National Laboratory. The dataset, known as the Berkeley Earth Surface Temperature Study, compiles 1.6 billion temperature reports from 16 pre-existing archives, including records from NASA, NOAA, and the UK Met Office.

Who collected the data? Berkeley Earth, utilizing multiple global climate sources.
When was it collected? The dataset includes records dating back to **1750** for land temperatures and **1850** for ocean temperatures.
Purpose of collection: The data was collected to **study global temperature trends**, reconstruct climate records, and provide a more comprehensive understanding of climate change.

4.a Dataset Details

The dataset contains multiple files, with **GlobalTemperatures.csv** being the primary file of interest. It includes:

- **Date:** Time series starting from 1750 (land) and 1850 (land & ocean).
- **LandAverageTemperature:** Global average land temperature in Celsius.
- **LandAverageTemperatureUncertainty:** 95% confidence interval for land temperature.
- **LandMaxTemperature & LandMinTemperature:** Global maximum and minimum land temperatures.
- **LandAndOceanAverageTemperature:** Combined global land and ocean temperature.
- **LandAndOceanAverageTemperatureUncertainty:** 95% confidence interval for combined temperature.

4.b Dataset Source & URL

The dataset is publicly available and can be accessed at:

📌 **Berkeley Earth Surface Temperature Data**

The dataset is provided at a monthly time interval, making it suitable for time series analysis of long-term climate trends.

This dataset will be instrumental in analyzing temperature variations, climate trends, and potential indicators of climate change across different regions and time periods.

5. Tools

I will be using python to analyze the data. Python libraries like pandas, numpy, matplotlib, statsmodels, scipy, scikit-learn and ARIMA for time series forecasting will be used.

The interface will be built using shiny app for the interaction to the users.