🔥 DSI321 Wildfire Alert System Project

Project Overview

This project aims to develop a **near real-time wildfire alert system** for Thailand using data from **NASA FIRMS** and **OpenWeatherAPI**, orchestrated by **Prefect** and visualized via **Streamlit**. It supports the work of the National Disaster Management Subcommittee by integrating technical data workflows with practical data governance and machine learning analysis.

The system includes:

- ETL pipeline via Prefect
- Data versioning with LakeFS
- Interactive map-based dashboard (Streamlit + Folium)
- Fire prediction analysis using Random Forest

🧠 Part 1: Technical Implementation (90 Points)

1. Repository Setup (10 Points)

- Repository created within the first week.
- Repository name: `dsi321_2025`
- File Structure:
  - `data/` – Wwather data in Parquet format
  - `visualization/shape_file/` – Geospatial shape files
  - `Machine_learning.ipynb` – ML model
  - `api/` – Scripts for ETL (e.g., `firmapiflow.py`, `apiweatherflow.py`)
  - `visualization/` – Streamlit dashboard

2. Commit Frequency (10 Points)

- Maintained a steady commit frequency:
  - ≥ 5 commits/week for 3 consecutive weeks

3. README Quality (10 Points)

- README contains > 1,000 characters
- Provides detailed breakdown of project objective, tools used, architecture, grading alignment

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4. Dataset Quality (50 Points)

Criteria	Status	Notes
≥ 1,000 Records	☑	Data collected every 15 min; > 96 records/day
24-Hour Time Coverage	☑	Daily collection via Prefect schedule

Criteria	Status	Notes
Data Completeness ≥ 90%	☑	Verified during ingestion using quality checks in Prefect
No `object` Columns	☑	Parquet format with clearly defined schema
No Duplicate Records	☑	Deduplication logic in Prefect ETL pipeline

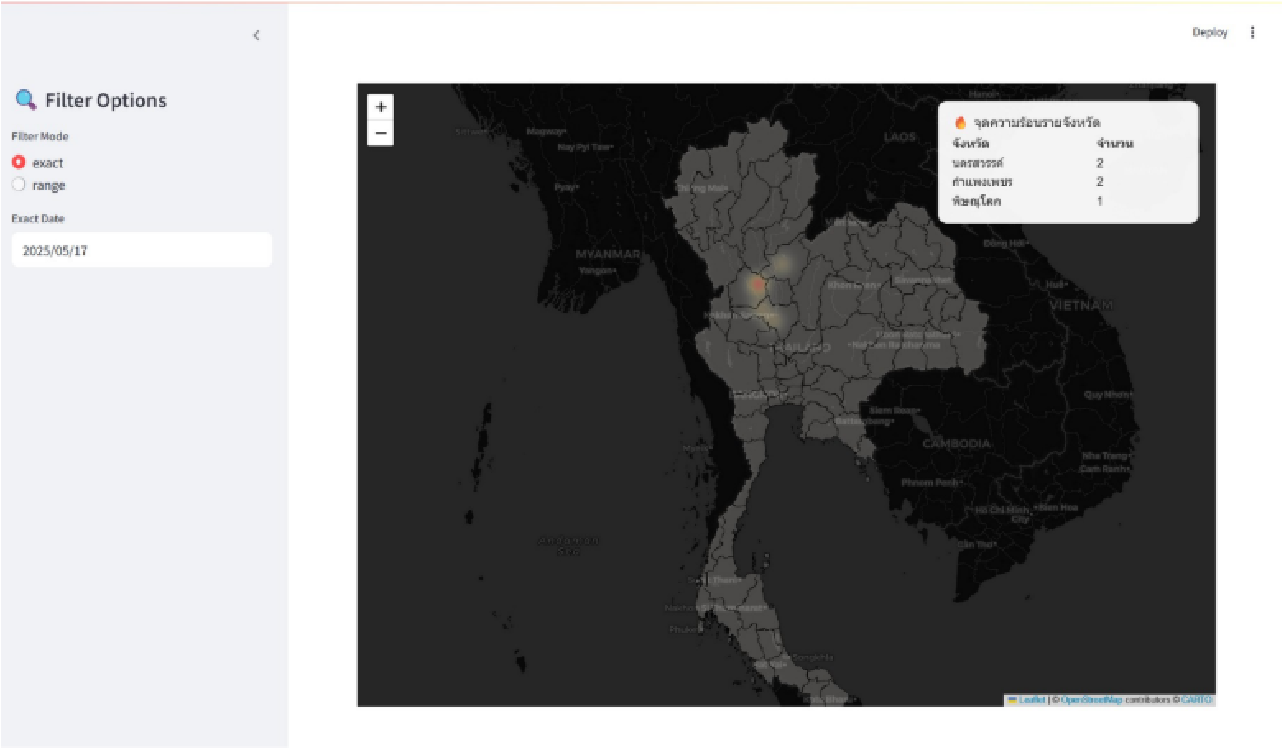
5. Schema Consistency (10 Points)

- Structured fields:
  - `timestamp` (datetime), `latitude`, `longitude`, `brightness`, `confidence`
  - `temperature`, `humidity`, `wind_speed` – all numeric
- Data types enforced via Parquet and LakeFS schema tracking

📊 Part 2: Project Report (10 Points)

1. Data Visualization (5 Points)

- Tools used: **Streamlit**, **Folium**, **GeoPandas**
- Key Visuals:
  - Heatmap of fire hotspots by province
  - Correlation matrix (weather vs brightness)
  - Scatter plots (e.g., temp vs brightness)
- Features:
  - Interactive map
  - Zoomable and filterable timeline



🔍 Filter Options

Filter Mode

● exact

○ range

Exact Date

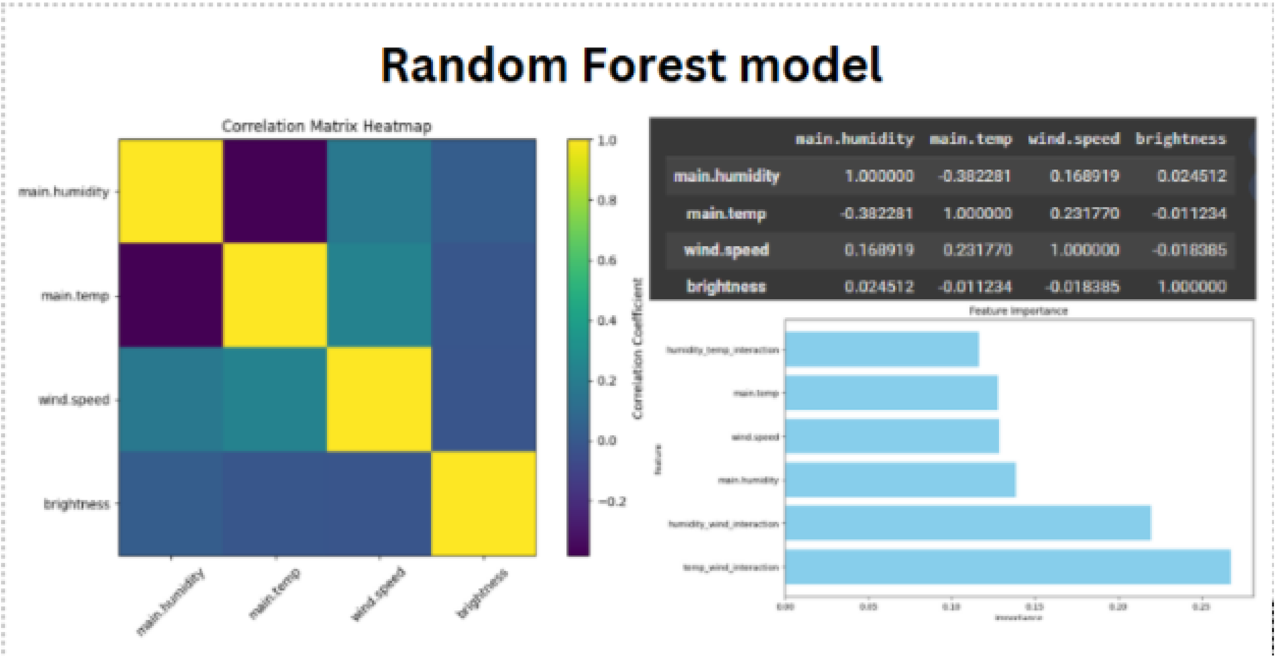
2025/05/17

🔥 จุดความร้อนรายจังหวัด

จังหวัด	จำนวน
นครสวรรค์	2
กำแพงเพชร	2
พิษณุโลก	1

2. Machine Learning (5 Points)

- Model: **Random Forest Regression**
- Target: `brightness`
- Features: `temperature`, `humidity`, `wind_speed`
- Results:
  - Feature importance analysis highlights temperature and humidity as key indicators
  - Correlation matrix supports feature relationships
- Tools: Scikit-learn, Matplotlib



	main.humidity	main.temp	wind.speed	brightness
main.humidity	1.000000	-0.382281	0.168919	0.024512
main.temp	-0.382281	1.000000	0.231770	-0.011234
wind.speed	0.168919	0.231770	1.000000	-0.018385
brightness	0.024512	-0.011234	-0.018385	1.000000

🛠 Tools & Architecture

Component	**Tool/Technology**
Data Ingestion	Prefect
Data Storage	LakeFS + Parquet
Dashboard	Streamlit + Folium
Geospatial Handling	GeoPandas
Machine Learning	Scikit-learn (RandomForest)
Metadata Management	CKAN

✅ Outcomes

- Automated ETL pipeline for real-time fire + weather data
- Complete interactive dashboard for decision makers
- Validated model identifying environmental factors affecting fire intensity
- Designed with scalability and data governance in mind

🚀 Getting Started Locally

1. **Clone the Repository**

```
git clone <repo-url>
cd <repo-folder>
```

2. **Start Services**

```
docker-compose up --build
```

After successful deployment, you can access:
Prefect Dashboard : http://localhost:4200
JupyterLab : http://localhost:8888
LakeFS : http://localhost:8000
Stramlit : http://localhost:8501

> [!IMPORTANT]
> Before executing `deploy.py`, you must first **create a repository named `weather` in LakeFS**.

3. **Deploy Prefect Flow**: Deploy the pipeline .:

```
# via JupyterLab at http://localhost:8888
## Start new terminal session

python apiweatherdeploy.py
python firmsapideploy.py
```

This creates a deployment in the `default-agent-pool` work 💡 Before deploying, ensure a weather repository exists in LakeFS.