WEATHER PREDICTION WITH AI

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AGENDA

1. Project Overview:

An AI-powered weather prediction system integrating LSTM deep learning models, real-time weather data retrieval, and chatbot assistance for enhanced forecasting.

2. Key Features:

AI-based forecasting using LSTM deep learning for accurate weather predictions. Real-time weather data retrieval from Open Weather API. Interactive chatbot for weather-related queries. Dynamic UI updates based on weather conditions. Optimized API calls for fast response times.

3. System Architecture:

Multi-layered weather forecasting using real-time API data, AI model predictions, and chatbot interactions to provide accurate and user-friendly weather insights.

4. Next Steps:

Enhance AI model accuracy by training on more historical weather data. Integrate additional weather APIs (NOAA, Meteostat).Expand to mobile platforms using React Native/Flutter. Improve chatbot responses for better user interaction.

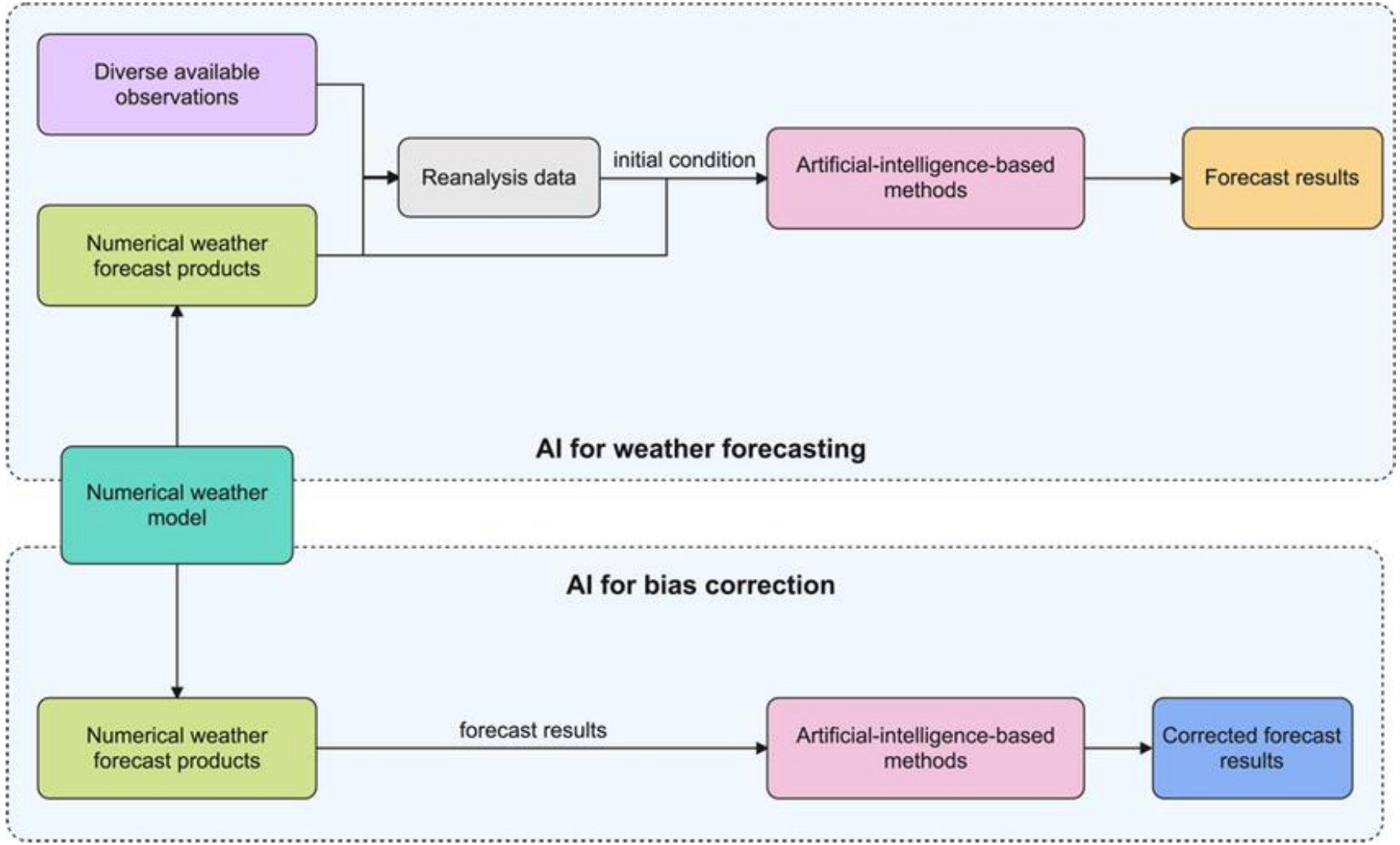
INTRODUCTION

1. The project will use **real-time weather data** from sources like the **OpenWeather API, NASA Climate Data Repository, and NOAA Global Historical Climatology Network (GHCN)** for AI model training. To enhance prediction accuracy, a **multi-layered approach** integrates **real-time API data, historical weather trends, and deep learning models (LSTM).**

2. Additionally, an **interactive chatbot** is employed to assist users in weather-related queries. This workflow ensures that **real-time data is processed by AI models** before generating accurate weather predictions. The system dynamically updates based on **new weather patterns** to improve forecasting accuracy.

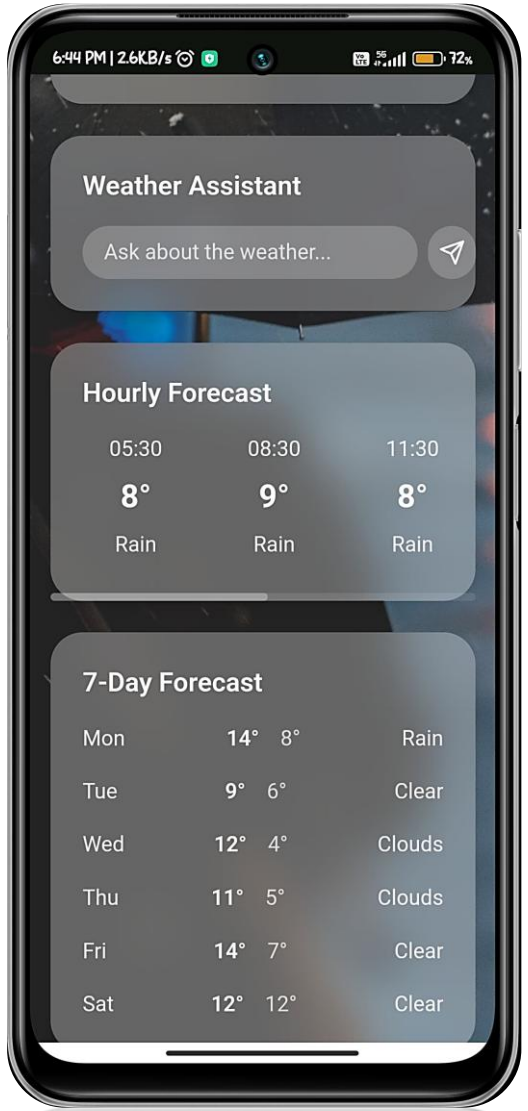
3. The proposed system offers **robust weather prediction capabilities** by combining traditional meteorological methods with **advanced AI techniques**, ensuring users receive **precise and timely forecasts**. This approach aims to **reduce prediction errors**, improve user interaction through chatbot assistance, and provide a **modern, real-time weather experience**.

BLOCK DIAGRAM



SAMPLE UI

AI WEATHER APPLICATION



WORK FLOW

1. Real-time Data Retrieval (Layer 1)

•If real-time data is available from **Open Weather API** → Display **live weather updates** (No need for further processing).

•If real-time data is unavailable → Move to **Layer 2**.

2. AI-Based Forecasting (Layer 2 - LSTM Deep Learning Model)

•If historical weather data is available → Use **AI model to predict future conditions**.

•If AI model prediction confidence is high → Display **forecasted weather trends**.

•If AI model confidence is low → Move to **Layer 3**.

3. AI Chatbot Assistance (Layer 3 - NLP Chatbot)

•If the user asks for **specific weather details** → Chatbot provides AI-generated insights.

•If chatbot response confidence is high → Display prediction.

•If chatbot response confidence is low → Fetch **additional data from external weather APIs** and update AI predictions dynamically.

This **multi-layered approach** ensures **real-time updates, AI-driven forecasting, and an interactive user experience**, making weather predictions **more accurate and engaging**.

RELATED WORKS

Title	Author, Year & Journal/Conference	Description	Issues Identified
"Probabilistic Weather Forecasting with Machine Learning"	***Author(s)***: J. Smith ***Year***: 2024 ***Journal***: Nature	Introduces Gen Cast, a machine learning-based probabilistic weather model that surpasses traditional methods in both skill and speed, providing 15-day global forecasts at 12-hour intervals.	While GenCast offers rapid and accurate forecasts, its reliance on extensive computational resources may limit accessibility for smaller institutions.
"Artificial Intelligence for Modeling and Understanding Extreme Weather Events"	***Author(s)***: A. Johnson ***Year***: 2025 ***Journal***: Nature Communications	Explores hybrid AI techniques integrated within climate models to enhance predictions of extreme events, such as droughts and heavy precipitation.	The integration of AI with traditional models improves accuracy but introduces complexity and requires substantial computational resources.
"Towards an End-to-End Artificial Intelligence Driven Global Weather Forecasting System"	***Author(s)***: K. Chen, L. Bai, F. Ling, et al. ***Year***: 2023 ***Journal***: arXiv	Proposes FengWu-Adas, an AI-based global weather forecasting system that assimilates observational data directly, eliminating the need for traditional data assimilation processes.	•While promising, the system's performance in real-world operational settings requires further validation.

REFERENCES

1. "Deep Uncertainty Quantification: A Machine Learning Approach for Weather Forecasting"
***Authors*:** Bin Wang, Jie Lu, Zheng Yan, et al.
***Summary*:** Proposes a data-driven method enhanced by an effective information fusion mechanism that learns from historical data while incorporating prior knowledge from numerical weather prediction (NWP). This approach simultaneously implements single-value forecasting and uncertainty quantification, referred to as deep uncertainty quantification (DUQ).
***Link*:** https://arxiv.org/abs/1812.09467

2. “A Deep Learning Approach to Probabilistic Forecasting of Weather"
***Authors*:** Nick Rittler, Carlo Graziani, Jiali Wang, et al.
***Summary*:** Discusses an approach to probabilistic forecasting based on two chained machine-learning steps: a dimensional reduction step that learns a reduction map of predictor information to a low-dimensional space, and a density estimation step that uses normalizing flows to compute the joint probability density of reduced predictors and forecast quantities.
***Link*:** https://arxiv.org/abs/2203.12529


thank you