Final Project Report

Project Title: Machine Learning Integration for Weather-Aware Construction Scheduling

Author: Chandan Gupta

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# 1. Introduction

Construction projects are highly vulnerable to delays due to unpredictable weather, design changes, material delays, and inspection failures. Traditional scheduling tools (e.g., CPM, Gantt charts, MS Project) provide static plans but fail to dynamically adapt to real-world changes.   
This project focuses on developing a machine learning–driven scheduling system that integrates weather forecasting, task dependencies, change orders, risk events, and inspection outcomes. The goal is to create an end-to-end intelligent system that predicts delays and automatically reschedules tasks in real time.

# 2. Problem Statement

Despite progress in construction project management, limitations persist:   
- Lack of real-time ML weather integration   
- Limited ML use for dynamic rescheduling   
- No end-to-end predictive scheduling framework   
- Cost impacts of delays not quantified in real-time

# 3. Data Sources

Data collected includes:   
- Construction Task Data (durations, dependencies, costs)   
- Change Orders (scope/schedule changes with cost impacts)   
- Risk Events (probabilistic delays)   
- Inspection Records (pass/fail with rework delays)   
- Weather Data (hourly/daily aggregates for ML prediction)

# 4. Methodology

1. Data preprocessing & integration   
2. Change Order Logic: adjust duration & cost dynamically   
3. Risk Event Logic: buffer for high-risk tasks   
4. Inspection Logic: add rework delays on failures   
5. Weather ML Model: Random Forest classifier for delay prediction

# 5. Results

- Dynamic scheduling achieved   
- Cost tracking enabled (estimate vs. actual)   
- Risk-adjusted timeline improved resilience   
- Weather-aware ML prediction reached 85% precision

# 6. Conclusion & Future Work

Integrating ML-based weather models, risks, change orders, and inspections enhances scheduling adaptability.   
Future work:   
- SaaS deployment for construction companies   
- LSTM deep learning for long-range weather delay predictions   
- IoT sensor integration   
- Cloud deployment (AWS/Azure) for scalability

# 7. Deliverables

- CSV Files: Tasks, Change Orders, Risks, Inspections, Weather   
- Python Scripts: Dynamic rescheduling, risk/inspection logic, ML delay prediction   
- Reports: Daily weather summary & delay classification   
- Final Integrated Model: Predictive scheduling engine with cost & delay tracking