**📄 Week 5 – CI/CD Pipeline with Azure DevOps (Expense Analysis)**

**CI/CD Pipeline Overview**

Continuous Integration (CI) and Continuous Deployment/Delivery (CD) help automate processes such as **data ingestion, cleaning, analysis, and reporting**.

For the **Expense Analysis System**, the CI/CD pipeline ensures that:

* Expense data is automatically processed on a weekly or monthly basis.
* Summary reports are generated without manual effort.
* Alerts are raised if expenses cross a defined threshold.

**Pipeline Flow for Expense Analysis**

1. **Data Fetching Stage**
   * Pipeline pulls data from CSV/API/database.
   * New expense records are appended to the system.
2. **Data Cleaning Stage**
   * Handle missing or duplicate entries.
   * Convert numeric fields (amount, savings) into proper formats.
3. **Expense Analysis Stage**
   * Aggregate weekly/monthly expenses.
   * Calculate total expenses, savings, and categories with high spending.
4. **Report Generation Stage**
   * Generate summary report as CSV or Excel.
   * Save the report as an artifact or send via email notifications.
5. **Alert Stage**
   * If expenses exceed a threshold (e.g., ₹50,000 per month), trigger an alert log.
   * Helps identify **overspending early**.

**Threshold Alerts**

* Rule: *If total monthly expenses exceed threshold (e.g., ₹50,000), log alert*.
* Alert will be recorded in pipeline logs or trigger a notification email.
* Example:
  + ⚠ Alert: *Expenses for August = ₹52,300 (Threshold ₹50,000 exceeded)*

*Sample Azure DevOps Pipeline YAML*

*trigger:*

*- main*

*schedules:*

*- cron: "0 0 1 \* \*" # Run on the 1st of every month*

*displayName: Monthly Expense Analysis*

*pool:*

*vmImage: 'ubuntu-latest'*

*steps:*

*- task: UsePythonVersion@0*

*inputs:*

*versionSpec: '3.x'*

*- script: |*

*pip install pandas numpy*

*python scripts/clean\_expenses.py*

*python scripts/analyze\_expenses.py --period monthly*

*displayName: 'Run Expense Cleaning and Analysis'*

*- script: |*

*python scripts/check\_threshold.py --limit 50000*

*displayName: 'Check Expense Threshold Alert'*

*- task: PublishBuildArtifacts@1*

*inputs:*

*pathToPublish: 'reports/'*

*artifactName: 'ExpenseReports'*

**Execution Log (Example)**

* ✅ Data loaded from expenses.csv
* ✅ Missing entries cleaned and validated
* ✅ Monthly summary generated → *August 2025 Total = ₹52,300*
* ⚠ Alert: *Threshold ₹50,000 exceeded*
* ✅ Report saved at /reports/monthly\_expense\_report.csv

**Final Deliverables**

1. **Azure DevOps YAML Pipeline** (to automate analysis & reporting)
2. **Execution Log** (to show alerts and processing steps)
3. **Monthly Expense Report (CSV/Excel)**