Mini Project Report

Project Title:

Village Water Usage Analysis System (Enhanced Version) using NumPy and Pandas

Student Name:

Sanjana Sherawat

Course:

MCA

Tools Used:

Python, NumPy, Pandas

1. Introduction

Water is a vital resource in rural areas. Proper management of water usage is essential to ensure every household has sufficient water and to prevent wastage.

This project analyzes **daily water consumption in a village** using **NumPy** and **Pandas**.

Enhancements in this version:

- Classification of water usage per household (Low / Normal / High)
- Analysis of rainfall effect on water consumption
- Estimation of next day water usage
- Identification of days with over-usage

2. Objective

- Analyze daily water usage per household using Python libraries.
- Identify high and low consumption days.
- Examine the effect of rainfall on water usage.
- Recommend a safe daily water usage range per household.
- Provide simple prediction for next day usage.

3. Technologies and Libraries Used

Library	Purpose
NumPy	Mathematical calculations (mean, standard deviation, predictions)
Pandas	Data cleaning, manipulation, grouping, and classification.

4. Dataset Description

The dataset contains 7 days of water usage in the village **Rampur**.

Date	Village_Name	Households	Total_Water_Used(L)	Rainfall(mm)
2025-06-01	Rampur	120	5400	2.5
2025-06-02	Rampur	120	6200	0.0
2025-06-03	Rampur	120	4800	5.0
2025-06-04	Rampur	120	5000	3.0
2025-06-05	Rampur	120	5500	0.0
2025-06-06	Rampur	120	5300	1.0
2025-06-07	Rampur	120	4900	4.0

6. Output Example

Average water per household per day:

Date	Avg_Water_Per_Household	Usage_Level
2025-06-01	45.0	Normal
2025-06-02	51.7	High
2025-06-03	40.0	Low
2025-06-04	41.7	Normal
2025-06-05	45.8	Normal
2025-06-06	44.2	Normal
2025-06-07	40.8	Normal

Recommended daily usage per household: 41–47 L/day
Average usage on rainy days: 42.8 L
Average usage on dry days: 48.8 L
Estimated usage for next day: 38.8 L/household
Days with over-usage: 2025-06-02

7. Insights

- **Normal usage**: Most households are within the recommended range.
- **High usage day**: June 2 — could indicate overuse or leakage.
- **Rainfall effect**: Water usage decreases on rainy days.
- **Next day planning**: Households can manage daily usage according to rainfall.

8. Applications

- Village water management and rationing.
- Awareness campaigns for water conservation.
- Planning storage and distribution efficiently.
- Can be extended with IoT sensors for **real-time monitoring**.

9. Conclusion

This enhanced project demonstrates:

- How **NumPy** and **Pandas** can solve real-life village problems.
- Ability to classify, analyze, and predict water usage patterns.
- Helps local authorities make informed decisions to **ensure sustainable water usage**.

10. Future Scope

- Visualize trends using Matplotlib/Seaborn.
- Extend dataset to multiple villages for regional analysis.
- Include per-household sensor data for better efficiency.
- Predict water shortage using **historical trends + ML**.