Smart Waste Management Sys.

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Overview

The "Waste Management Prediction using Machine Learning" project aimed to predict waste generation patterns based on various factors, such as temperature, day of the week, time of day, population density, and household income. Using **synthetic data**, a **Linear Regression model** was developed to estimate waste generation, and an interactive web-based dashboard was created to allow users to receive real-time predictions by providing input data.

Project Details:

- **Objective:**

  The main objective was to develop a machine learning solution for waste management to predict waste generation levels. The project was initiated to address the growing challenges in waste management and improve planning and resource allocation.

- **Methodology:**

  Data Generation: Synthetic data was generated to simulate waste management data, allowing for initial model development without real-world data.

  Data Preprocessing: The data was cleaned and transformed, ensuring it was suitable for model training.

  Feature Selection: Relevant features, including temperature, day of the week, time of day, population density, and household income, were selected for model training.

  Model Training: A Linear Regression model was trained using Scikit-learn, leveraging the synthetic data and selected features.

  Model Evaluation: The model's performance was assessed using evaluation metrics such as Mean Squared Error (MSE) and R-squared (R2).

- Technical Stack:

  Programming Language: Python

  Libraries: Pandas, NumPy, Scikit-learn, Matplotlib, Seaborn, Dash

  Version Control: Git

Key Contributions:

Developed and optimized the Linear Regression model to achieve high accuracy, with an MSE of 1.29 and R2 of 1.0.

Created an interactive web-based dashboard using Python's Dash library, allowing users to input data and receive real-time waste generation predictions.

Conducted data visualization to gain insights into waste generation patterns and feature relationships.

Prepared comprehensive project documentation, including code, methodology, results, and insights.

Results and Impact:

The project's success in accurately predicting waste generation patterns provides valuable insights for waste management planning and resource allocation. The interactive dashboard offers a user-friendly tool to make real-time predictions, contributing to efficient waste management practices..

Project Duration:

July 2023

GitHub Repository:

A Git repository containing the project code, synthetic data, and documentation is available at https://github.com/sandip-pathe/waste-man-ml

Personal Reflection:

The "Waste Management Prediction using Machine Learning" project was an exciting opportunity to apply data science and machine learning skills to address a critical real-world challenge. The experience of developing an interactive dashboard was particularly rewarding, as it allows users to interact with the model and witness its predictions in real-time. This project reaffirmed my passion for data science and my commitment to solving complex problems using data-driven approaches.

#Data processing using **pandas**

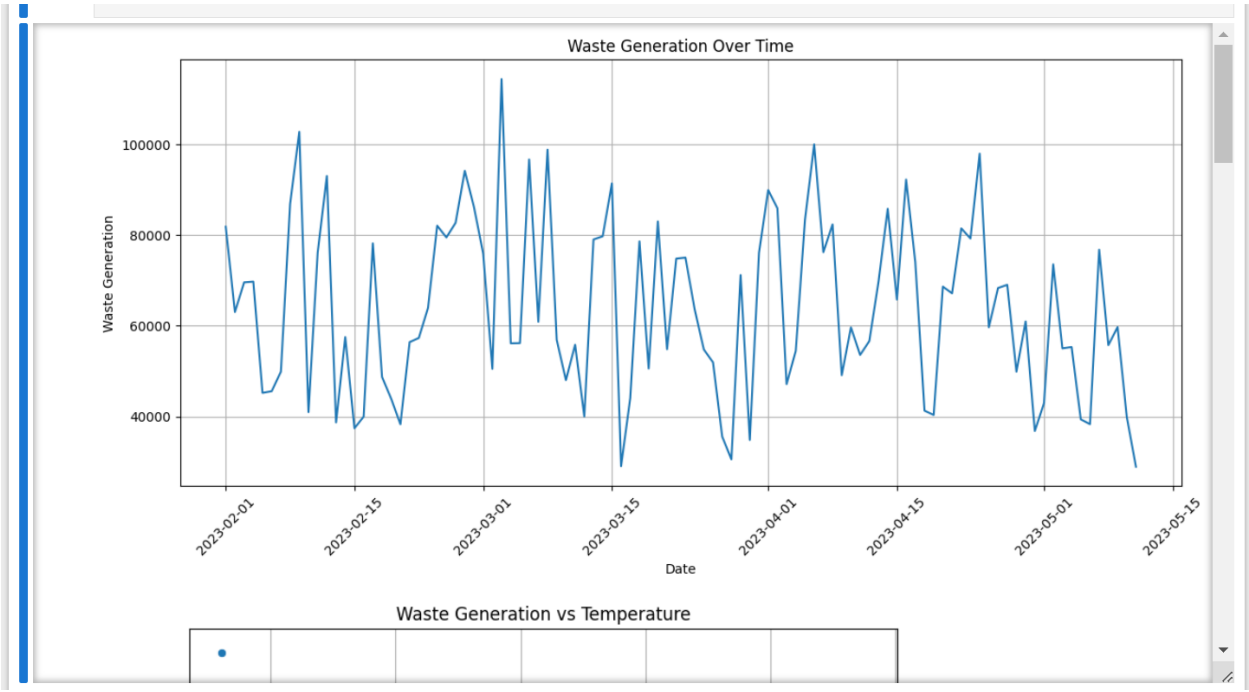
```
# Save
df_complex.to_csv('complex_waste_data.csv', index=False)
```

[2]:
```
with open("complex_waste_data.csv", "r") as data:
    sandip = data.read()
    print(sandip)
```

```
Date,Temperature (Â°C),Day of Week,Time of Day,Population Density,Household Income,Waste Generation
2023-02-01,20.26,2,9,19022,73518,81883.22807174918
2023-02-02,25.25,2,14,13823,42391,63052.30917367203
2023-02-03,14.22,2,14,16122,46059,69599.68711133272
2023-02-04,35.82,5,13,13244,55585,69771.50200934522
2023-02-05,25.15,4,11,5145,39608,45207.8337899072
2023-02-06,33.63,3,10,13692,33022,45580.86615424216
2023-02-07,38.78,3,14,11559,45524,49885.274645317644
2023-02-08,36.43,4,22,8697,73074,86876.59305659408
2023-02-09,25.18,5,4,14781,78531,102838.31735354933
2023-02-10,33.71,5,18,7939,30809,40962.54217328232
2023-02-11,26.32,6,4,9980,64383,76173.90354896818
2023-02-12,16.97,1,13,14809,67353,93089.70006416235
2023-02-13,35.59,0,5,5901,29429,38681.14633508571
2023-02-14,16.6,1,1,6364,59663,57527.54338113609
2023-02-15,30.42,4,7,5590,31199,37398.21676273337
2023-02-16,34.85,3,11,7086,31027,39960.49174949239
2023-02-17,24.56,6,5,5329,61079,78210.5707625896
2023-02-18,14.84,4,5,6910,36996,48727.68995143594
2023-02-19,25.0,1,18,13142,32819,43889.7264585102
2023-02-20,24.17,4,13,18045,27422,38278.50629328327
2023-02-21,23.65,5,13,16880,46224,56410.60945866547
2023-02-22,23.22,1,13,13718,52100,57327.477644849954
2023-02-23,24.37,6,10,17525,39956,63949.343146424435
```

[3]:
```
!pip install matplotlib
```

#Data Visualization using **matplotlib**



#Dashboard using **Dash lib**

```
`import dash_core_components as dcc` with `from dash import dcc`
  import dash_core_components as dcc
C:\Users\Sandip\AppData\Local\Temp\ipykernel_6052\466492038.py:3: UserWarning:
The dash_html_components package is deprecated. Please replace
`import dash_html_components as html` with `from dash import html`
  import dash_html_components as html
```