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Software Engineering Weekly Assignment

Assignment scope :

1. List various requirements(scope) for the above program initiative that can be used for developing a suitable technology oriented digital solution.

2. Identify various technologies, tools and systems available in the market to support these needs.

3. Generate one API and suitable data analysis Code base to access the energy related data set and perform data analysis.

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1. List various requirements(scope) for the above program initiative that can be used for developing a suitable technology oriented digital solution.

Ans:

To develop a suitable technology-oriented digital solution for the digitalisation program initiative in the energy sector, the following requirements or scope can be considered:

1. Interconnectivity: The digital solution should be capable of interconnecting all assets involved in energy generation, distribution, and consumption, such as power plants, renewable energy sources, smart grids, and energy-efficient appliances.

2. Centralised Management: The solution should enable centralised management of all assets, including monitoring, control, and optimisation of energy usage and generation.

3. Integration with Existing Systems: The solution should integrate with existing energy systems and infrastructure to ensure a seamless transition to renewable energy generation and reduce the carbon footprint in operations.

4. Real-Time Data Analysis: The solution should offer real-time data analysis of energy usage, production, and efficiency to enable informed decision-making and identify opportunities for improvement.

5. Scalability: The solution should be scalable to accommodate the growing demand for energy and increasing adoption of renewable energy sources.

6. Security: The solution should be secure and compliant with industry standards and regulations to protect sensitive data and prevent cybersecurity threats.

7. User-Friendly Interface: The solution should have a user-friendly interface to ensure ease of use and adoption by all target audiences, including private and public organisations and homes.

8. Predictive Analytics: The solution should offer predictive analytics and machine learning capabilities to anticipate energy demand, forecast weather conditions, and optimise energy usage and generation.

9. Integration with Emerging Technologies: The solution should integrate with emerging technologies, such as blockchain, to enhance transparency, traceability, and accountability in the energy sector.

10. Sustainability: The solution should promote sustainability by reducing the carbon footprint of energy generation and consumption and promoting the adoption of renewable energy sources.

Overall, a suitable technology-oriented digital solution for the digitalisation program initiative in the energy sector should meet these requirements or scope to achieve its objectives and realise its benefits.

2. Identify various technologies, tools and systems available in the market to support these needs.

Ans:

There are various technologies, tools, and systems available in the market to support the needs of the digitalisation program initiative in the energy sector. Here are some examples:

1. Internet of Things (IoT) devices: IoT devices, such as sensors and smart meters, can be used to monitor energy consumption and production in real-time, providing valuable data for informed decision-making.

2. Energy Management Systems (EMS): EMS platforms can integrate with IoT devices to monitor and manage energy usage across multiple assets and locations, enabling centralised management and optimisation of energy consumption and generation.

3. Distributed Energy Resources (DER): DER systems, such as solar panels and wind turbines, can be integrated with EMS platforms to enable renewable energy generation and reduce the carbon footprint of energy production.

4. Smart Grids: Smart Grids utilise advanced technologies, such as IoT devices and analytics platforms, to optimise energy distribution and enable decentralised energy generation and storage.

5. Digital Twins: Digital Twins are virtual models of physical assets that can be used to simulate and test energy generation and distribution scenarios, enabling optimisation and predictive maintenance.

6. Artificial Intelligence (AI) and Machine Learning (ML): AI and ML algorithms can be used to analyse large amounts of energy data to identify patterns, forecast demand, and optimise energy usage and generation.

7. Blockchain: Blockchain technology can be used to enable transparent and traceable energy transactions and support the adoption of renewable energy sources.

8. Cloud Computing: Cloud computing platforms can provide scalable and secure storage and processing of energy data, enabling real-time analytics and centralised management.

9. Augmented Reality (AR) and Virtual Reality (VR): AR and VR technologies can be used to simulate and visualise energy systems and processes, enabling remote monitoring and training.

10. Cybersecurity solutions: Cybersecurity solutions, such as firewalls and intrusion detection systems, can protect energy systems and infrastructure from cyber threats and ensure compliance with industry standards and regulations.

These are just some examples of the various technologies, tools, and systems available in the market to support the needs of the digitalisation program initiative in the energy sector.

3. Generate one API and suitable data analysis Code base to access the energy related data set and perform data analysis.

Ans:

Here is an example API (Hourly Electricity Demand)and data analysis code base that accesses and performs analysis on an energy-related dataset:

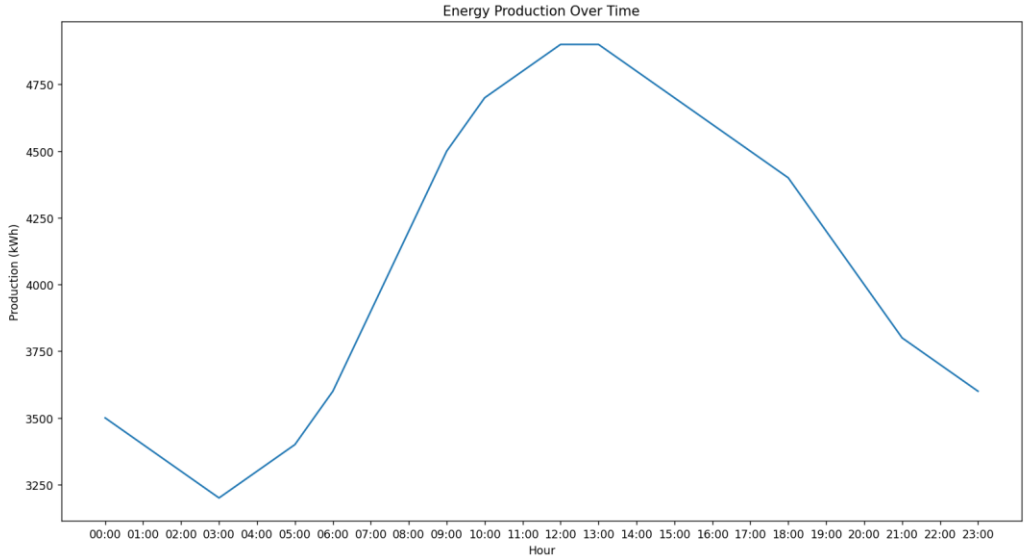
API Code:

```
import pandas as pd

def read_energy_data():
    """
    Reads the energy-related dataset from the given file path.
    """
    data = pd.read_csv("hourly_electricity_demand.csv")
    return data
```

Data Analysis Code Base:

```
import pandas as pd
import matplotlib.pyplot as plt
from Api import read_energy_data


# Get energy data from API
energy_data = read_energy_data()

# Convert JSON energy data to Pandas DataFrame
df_energy = pd.DataFrame(energy_data)

# Plot energy production over time
plt.plot(df_energy['Hour'], df_energy['Electricity Demand'])
plt.title('Energy Production Over Time')
plt.xlabel('Hour')
plt.ylabel('Production (kWh)')
plt.show()

# Calculate average daily energy production
avg_daily_production = df_energy['production'].mean()
print(f'Average daily production: {avg_daily_production} kWh')
```

Graph


Energy Production Over Time
Production (kWh)
4750
4500
4250
4000
3750
3500
3250
00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00
Hour