

Visualization of the gasification project of buildings based on computer modeling

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Abstract: Organizations are always looking for innovative methods to effectively share insights and get value from their data in today's data-rich environment. With dynamic and engaging images, users may explore and comprehend data thanks to the potent interactive data visualization technology. The article aims to discuss the importance, benefits, and techniques of Interactive Data Visualization.

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Understanding Interactive Data Visualization

Interactive data visualization takes static data visualization a step further by allowing users to directly interact with the data itself. It gives users the ability to compare various datasets, dive down into specifics, engage with data in real time, and find hidden patterns and correlations. Organizations may enhance communication, make data-driven decisions, and eventually get a competitive advantage by doing this.

Importance of Interactive Data Visualization

Users love to interact and engage with data via interactive data visualization. It produces visual content—charts, graphs, maps, and dashboards—that react to user interaction, clicks, hovers, and filter presses to disclose more details, explore data in depth, or alter the visualization's look. The value of interactive data visualization is found in its capacity to streamline complicated data, improve accessibility and comprehension, and ease the exploration and study of data.

Key reasons for the importance of interactive data visualization are as follows:

1. **Enhanced Data Understanding:** Abstract data becomes more concrete and understandable when presented via interactive visualizations. Context, linkages, and exploration allow people to better understand complicated ideas, see patterns, and come to quicker, more educated judgments.
2. **Enhanced Data Exploration:** Users to interact with the data making it easier for them to explore various situations, dig deeper into the data, and find insights that they would have missed otherwise.
3. **Effective Communication:** Interactive visualizations go beyond the idea that images are a universal language. Complex concepts may be conveyed more successfully to a variety of audiences by presenting data in a dynamic and engaging way, which can help to align stakeholders and foster agreement.
4. **Data-Driven Decision Making:** By including sophisticated analytical functions, interactive data visualization tools often help users see patterns, correlations, and outliers more quickly. This facilitates improved decision-making by offering predictive analytics capabilities and actionable insights.

Modern Data Visualization

Immersive, dynamic visualizations have replaced static, one-dimensional charts as the primary form of data display. An age of dynamic and captivating data storytelling has begun thanks to the advancement of modern data visualization tools and technologies, which have completely changed how data is displayed and consumed.

1. **From Static to Dynamic:** Historically, data visualization has required the creation of fixed-representation charts and graphs. Although helpful, these visualizations lacked the complexity and interaction necessary for a thorough analysis of the data. This has changed because to modern technologies, which enable dynamic visualizations that react to user inputs, providing a more flexible and sophisticated comprehension of data.
2. **2D to 3D Immersion:** Three-dimensional data visualization, which takes consumers on a trip through data, is made possible by technological advancements. In particular for geographical data and intricate simulations, 3D visualizations—such as interactive maps, virtual reality infographics, and holographic representations—offer a more realistic and immersive viewpoint.

3. **Single to Multi-Layered Views:** Modern visualizations often use dashboards or multi-layered views in place of a single chart. These provide consumers access to several viewpoints on the data, enabling them to go deeper into certain areas of interest and investigate multiple aspects, ultimately yielding a more thorough comprehension.
4. **Storytelling:** Data storytelling has progressed from being a passive form of consumption to a participatory narrative. With the help of contemporary technologies, users may create guided, interactive tales in which data visualizations react and change in response to the story, drawing viewers in and letting them delve deeper into the nuanced aspects of the data.

Features and Benefits of Modern Interactive Visualizations

Numerous elements that increase data analysis and user experience are available in modern interactive data visualizations:

- **Filtering and Slicing:** By allowing users to compare different segments, concentrate on certain data subsets, or examine data from many dimensions, interactive filters and slicing tools may uncover hidden patterns.
- **Updates in real time:** By connecting visualizations to real-time data sources, users can keep an eye on changes and respond to them as they happen.
- **Customizable Views:** Users may rearrange dashboard components for individualized insights, choose certain metrics, or change the style of graphic to better suit their needs.
- **Collaborative Features:** A lot of modern technologies come with collaborative features that let teams debate findings, share and annotate visualizations, and make choices based on data and tactics in tandem.
- **Advanced Analytics:** By combining statistical models, machine learning algorithms, and predictive analytics, one may better detect patterns, correlations, and anomalies, which facilitates more precise forecasting and decision-making.
- **Data Integration:** With the help of modern platforms, disparate data sources may be integrated to provide a single picture of the data and make it easier to conduct thorough analyses that take into account a variety of aspects.

Better data interpretation, a quicker time to insight, more teamwork, and more efficient communication are some advantages of these qualities, which improve decision-making and business results.

Benefits of Interactive Data Visualization

Advantages in Spotting Trends and Assessing KPIs

The capacity of interactive data visualization to assist users in recognizing patterns and more efficiently monitoring key performance indicators (KPIs) is one of its main benefits:

- **Trend Identification:** Users may examine data over time using interactive visualizations, which makes it possible to see patterns and trends that static charts could miss. Users are able to identify emerging patterns, predict changes, and create data-driven predictions by changing time ranges, comparing different eras, and evaluating data at different levels of detail.
- **KPI Monitoring:** Vital KPIs may be dynamically and in real-time shown via customization of visualizations, giving an insight of company performance. In order to ensure that plans stay on course and to enable a more proactive approach to managing operations, dashboards may incorporate several metrics, allowing users to monitor, evaluate, and respond to changes in important indicators.
- **Correlation Analysis:** Users may identify dependencies and correlations by interactively examining the connections between various data variables. This makes it easier to pinpoint the variables affecting KPIs, enabling more focused interventions and effective performance-enhancing tactics.

Additional Benefits of Interactive Data Visualization

In addition to trend identification and KPI evaluation, dynamic data visualization has other benefits.

- **Simplified Complex Data:** Visualizations help a wider audience grasp abstract topics by turning complex facts into easily consumable images.

- **Faster Insights:** Users can see patterns, anomalies, and opportunities more quickly because to the interactive visualizations, which speeds up the exploration process and improves time-to-market and decision-making.
- **Better Data Quality:** Inconsistencies or outliers in the data may be found more easily via interactive exploration, which makes data cleaning easier and boosts overall data quality.
- **Engaging Communication:** Data presentations become more memorable and captivating when they include dynamic and engaging images that hold the audience's attention and help them comprehend the message.
- **Self-Service Analytics:** Encouraging users to investigate data on their own lightens the workload for IT teams and data analysts while promoting an organizational culture that relies heavily on data to make decisions.

Interactive Data Visualization using Plotly

Plotly can be used for various interactive data visualizations in python, here is an example of how we can plot a line graph using plotly.

```
import plotly.express as px
```

```
# using the iris dataset
```

```
df = px.data.iris()
```

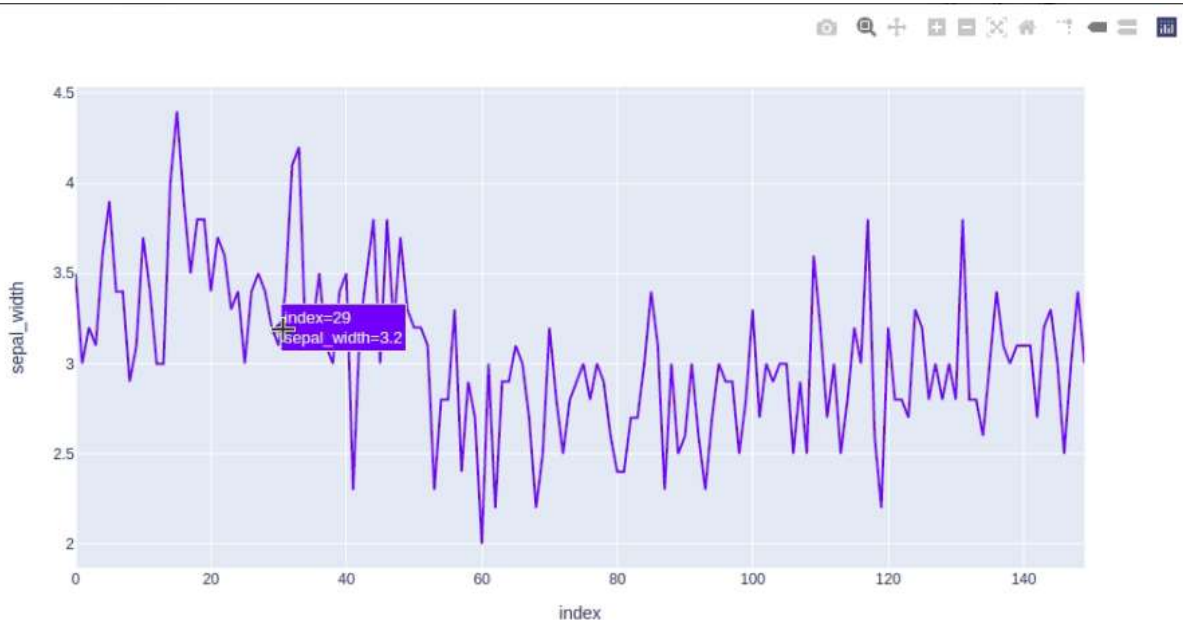
```
# plotting the line chart
```

```
fig = px.line(df, y="sepal_width",)
```

```
# showing the plot
```

```
fig.show()
```

Output:



Interactive Data Visualization using Bokeh

In this section, we will utilize *Bokeh library* to plot the relationship between x and y data points, with specific values plotted at discrete steps.

```
# Importing Bokeh Library
```

```
from bokeh.plotting import figure, output_file, show
```

```
# Importing numpy for calculating sin values
```

```
import numpy as np
```

```
x = [1, 2, 3, 4, 5]
```

```
y = [6, 7, 2, 4, 5]
```

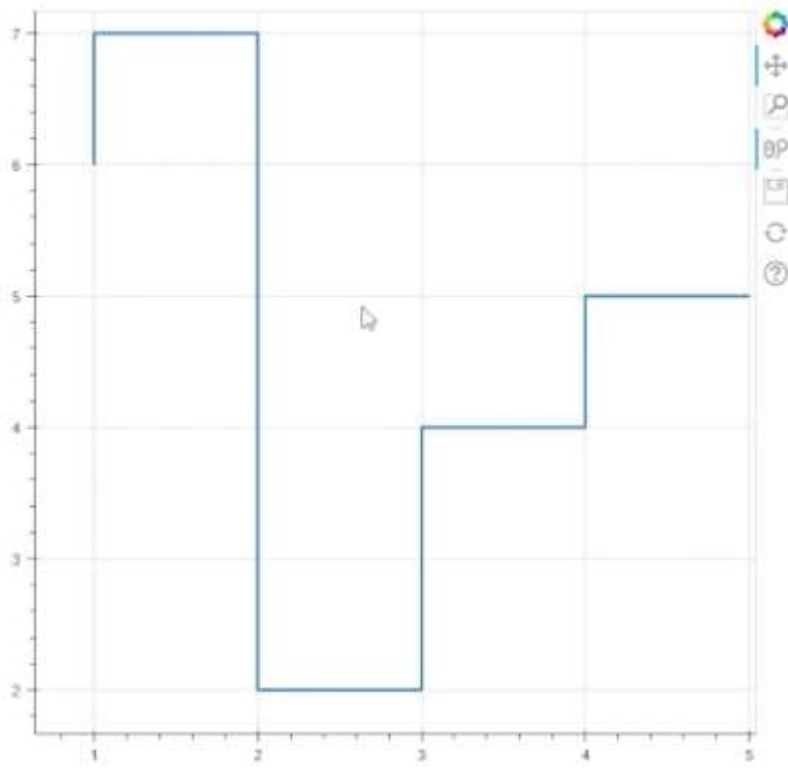
```
fig = figure()
```

```
fig.step(x, y, line_width=2)
```

```
# Image Showing
```

```
show(fig)
```

Output:



An effective tool for examining and sharing data insights is interactive data visualization. Through adherence to a methodical approach and utilization of contemporary visualization instruments, establishments may fully use their data assets, propel data-supported choices, and unearth significant revelations that were hitherto obscured inside intricate datasets.

Conclusion

In conclusion, the way we examine and comprehend data has been completely transformed by interactive data visualization. It has grown to be an essential tool across a variety of sectors by allowing users to actively interact with visualizations, pose questions, and discover insights catered to their particular requirements. The capacity to interact with visualizations will become more and more important for efficient data analysis, communication, and decision-making as data volume and complexity continue to rise.

Literature:

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2. Building Energy Simulation: Theory and Practice
3. Introduction to Building Energy Modeling" (Xun, W. 2010).