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Descriptive Data Visualization Dashboard of LQ45 Stock Price Movements using Pygwalker

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Abstract: This research aims to design and develop a descriptive data visualization dashboard for analyzing stock price movements on the LQ45 index. The interactive dashboard is designed to present a summary of descriptive statistics, historical trends, and stock price volatility of LQ45 constituents. The research method applied refers to the CRISP-DM approach and the Dashboard Design Pattern principle, which includes stock price data collection, descriptive statistical analysis, and effective data visualization design. The results of this research are expected to be a useful tool in providing an overview of historical stock price patterns with an interactive approach.

Keywords: Data Visualization, PygWalker, LQ45 Stocks, LQ45 Stock Price Movements.

INTRODUCTION

The capital market is an important indicator that reflects investment activity and market players' confidence in economic conditions [8]. One of the main stock indexes in Indonesia is the LQ45 Index, which consists of the 45 most liquid stocks with large capitalizations [8]. However, stock price movement data is often presented in raw tabular form, which is less intuitive to analyze, especially for novice investors [3].

Data visualization is a solution by transforming complex information into graphical displays that are easier to understand and interpret [3]. Therefore, this study focuses on designing a descriptive data visualization dashboard to present stock price movements in the LQ45 Index in a more interactive and informative manner.

- How to build an interactive dashboard to visualize stock price movement data in the LQ45 index?
- How to utilize PygWalker in creating graphic visualizations and summaries of stock price movement data?
- How can visualization depict the trend and distribution of stock prices over the time period contained in the dataset?

METHODOLOGY

Dashboard Design Pattern

*Dashboard*Design patterns are general solutions to design problems that frequently arise in development.*dashboard*This pattern is descriptive and is obtained from

observations of various*dashboard*real-world applications in areas such as healthcare, finance, and transportation. These patterns help designers choose the right interface elements, both in terms of structure, visualization, and interactivity, without setting rigid rules about how to*dashboard*must be made.

In general, design patterns are divided into two main groups, namely*Content Design Patterns* And *Composition Design Patterns*.

- *Content Design Patterns*includes data types and forms of presentation, such as raw data, aggregates, trends, and so on.*threshold*Meta information includes data sources and indicator explanations. Common visualization formats include tables, lists, and interactive charts.
- *Composition Design Patterns*focus on layout, interaction, and structure*dashboard*. This includes setting*layout* (*stratified*, *grouped*, *table*, *open*), screen space management (*screenfit*, *overflow*, *detail-on-demand*, *parameterization*, *multiple pages*), page structure (*parallel*, *hierarchical*, *open*), user interaction (*exploration*, *drilldown*, *navigation*, *personalization*), as well as the use of color (*shared color schemes*, *data encoding*, *semantic colors*, *emotive color schemes*) to improve readability and visual appeal [1].

CRISP-DM

CRISP-DM is an industry-independent process model for data mining. This model consists of six iterative phases from business understanding to implementation as seen in Figure 1 [7].

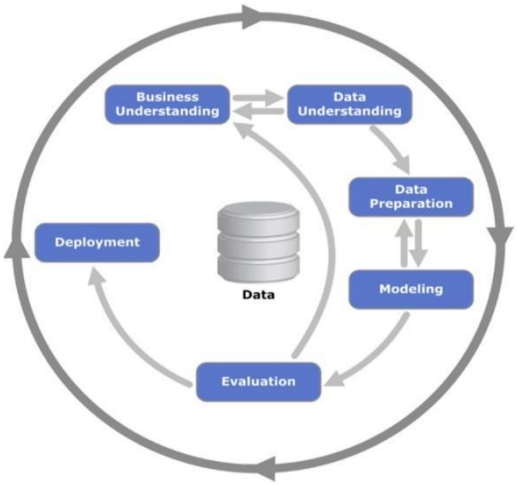

Figure 1. CRISP-DM Methodology

Research using the method*CRISP-DM* (*Cross-Industry Standard Process for Data Mining*) as the main approach in the data analysis and visualization process.*CRISP-DM*is a flexible and process-oriented methodology, which is widely used in projects.*data mining* And *data science*in various industries.

This method consists of six main stages which are interrelated and iterative, namely:*Business Understanding*, *Data Understanding*, *Data Preparation*, *Modeling*, *Deployment*, And *Evaluation*as in Figure 1.

1. *Business Understanding*
   In the initial stage, the collection of conceptual information and formulation of system requirements is carried out as a basis for understanding the scope and direction of the design.*dashboard*Descriptive data visualization related to stock price movements on the LQ45 index.
2. *Data Understanding*
   At this stage, an initial exploration is carried out on the data that has been prepared, which is sourced from the repository.*GitHub*at the addresshttps://github.com/wildangunawan/Dataset-Saham-IDX.gitThis process includes checking the column structure as well as the amount of data or*record* which are available.
3. *Data Preparation*
   At the level *Data Preparation*, the data obtained through the previous process underwent cleaning, which included merging 56 issuers, deleting empty data, and adjusting data types.
4. *Modelling*
   For *Modelling*, planned the form of visualization that will be used in *dashboard*, taking into account the type of data available and the purpose of presenting the information descriptively.
5. *Deployment*
   At the level *Deployment*, the making is done*dashboard*which has been designed using the principles*Dashboard Design Pattern*.
6. *Evaluation*
   In the last stage, the collection of evaluations is done *dashboard*, which includes design aspects as well as achieving design objectives, using a questionnaire distributed to users.

RESULTS AND DISCUSSION

This section explains the results of each stage of the research, from Business Understanding to Evaluation.

Business Understanding

Level *Business Understanding*is the first step in the methodology*CRISP-DM*which serves as the basis for formulating the main research objectives and understanding the needs and context of the problems to be solved. In the context of this research, the focus is directed at understanding user needs, particularly in presenting historical data on stock price movements included in the LQ45 index.

Based on the problem identification conducted, the primary objective of this research was established: to develop a descriptive data visualization dashboard designed to present LQ45 stock price movement information interactively and informatively. The information displayed covers various important aspects of the data, such as daily price trends and comparisons between issuers over a specific time period. Additional features, such as data filtering by time period and issuer selection, are also designed to support flexibility in data exploration.

At this stage, the scope and limitations of the research have been identified.

This allows for a systematic visualization development process. The data used is limited to historical stock price data that is open and publicly available. The visualizations developed are descriptive in nature, without incorporating predictive analysis techniques.

Overall, level *Business Understanding*serves as a conceptual foundation in the data analysis process. A clear understanding of user needs and business objectives is necessary for the dashboard developed to address the issues raised and provide practical benefits in understanding stock market dynamics through a visual approach.

Data Understanding

At the level *Data Understanding*, an initial exploration was carried out on the dataset used in the research.*Dataset*are obtained online through open repositories available at*GitHub* https://github.com/wildangunawan/Dataset-Saham-IDX.git, which specifically provides historical data on stocks listed on the Indonesia Stock Exchange (IDX).

*Dataset*The dataset used consists of combined data from 56 stocks included in the LQ45 index, totaling 68,284 rows of data representing stock trading activity from various issuers over a specific period. Each row of data represents a single trade entry from a single issuer on a specific date. Overall, this dataset contains 26 columns, reflecting various aspects of stock trading activity.

Data Preparation

At the level *Data Preparation*, a series of processes are carried out to prepare the raw data so that it is ready to be used in visualization analysis. The first step is to combine**56 file CSV**each of which contains historical stock price data from issuers in the LQ45 index. This process produces**one integrated dataset**which allows for both cross-issuer and per-issuer analysis.

```
# The folder path where the CSV file is located
folder_path = '/content/Raw'

# Get all CSV files from folder
all_files = [f for f in os.listdir(folder_path) if f.endswith('.csv')]

# Load all files into the list
dfs = []
for filename in all_files:
    df = pd.read_csv(os.path.join(folder_path, filename))
    df['Saham'] = filename.replace('.csv', '')
    dfs.append(df)

# Continue only if there is a dataframe that was successfully read
if dfs:
# Merge all dataframes into one
    df_all = pd.concat(dfs, ignore_index=True)

    # Save the combined file in the same directory as the script
    output_file = 'combination_of_all_shares.csv'
    df_all.to_csv(output_file, index=False)
```

After the merge process, data cleansing is performed, including selecting relevant columns, adjusting column names for consistency, and converting date data types to datetime64[ns] format to support time series analysis. Null value checking is also performed to ensure data completeness, while duplicate removal is considered an optional step, although not yet implemented in the current implementation.

```
import pandas as pd
imports
```

```
df = pd.read_csv('/content/gabungan_semua_saham.csv')
print("Original Data Info:")
df.info()
print("\nOriginal Data Head:")
print(df.head())

# Select the required columns
columns_to_keep = ['date', 'Saham', 'open_price', 'high', 'low', 'close']
df_cleaned = df[columns_to_keep].copy()

# Rename the 'Stock' column to 'issuer'
df_cleaned.rename(columns={'Saham': 'emiten'}, inplace=True)

# Convert 'date' column to datetime format
try:
df_cleaned['date'] = pd.to_datetime(df_cleaned['date'], format='ISO8601')
except Exception as e:
print(f"Could not parse with ISO8601, trying mixed format. Error: {e}")
df_cleaned['date'] = pd.to_datetime(df_cleaned['date'], format='mixed')

# Check missing values
print("\nMissing values in cleaned data:")
print(df_cleaned.isnull().sum())

print("\nCleaned Data Info:")
df_cleaned.info()
print("\nCleaned Data Head:")
print(df_cleaned.head())

# Save the cleaning results
output_dir = 'Cleaned'
if not os.path.exists(output_dir):
os.makedirs(output_dir)

output_path = os.path.join(output_dir, 'cleaned_saham_data.csv')
df_cleaned.to_csv(output_path, index=False)

print(f"\nPreprocessing complete. Cleaned data saved to '{output_path}'")
```

Modelling

Designing a conceptual model is a crucial step before building a data visualization dashboard because it serves two fundamental purposes. First, it ensures that each visualization presented has a clear and relevant purpose, preventing the dashboard from becoming a jumble of unfocused and difficult-to-understand graphs. Second, it serves as a precise technical roadmap, making the development process much more efficient by defining precisely what components should be built and what data is needed. In short, modeling ensures that the resulting dashboard is targeted and built efficiently. A model of the designed dashboard can be seen in Table 1.

Table 1. Visualization Model

Component Name	Description	Objective	Dimensions
Line Chart Price *Close* And *High*	Visualization of the average price trend of LQ45 shares.	Looking at the general market trend of the LQ45 index.	*Date*, *Close*,*High*
Box Plot Price *Close*	Distribution and spread of LQ45	Comparing stability between stocks.	Issuer,*Close*

	stock price volatility.		
Line Chart Price *Close* And *High*Three Volatile Issuers	Comparison of price trends for the 3 most volatile issuers.	Monitor the movements of the most volatile stocks.	*Date*, *Close*, *High*, Issuer
Scatter Plot Price *Low vs High*	Comparison of daily price ranges (*High - Low*) per issuer.	Find the issuer with the largest daily price fluctuations.	*Low*, *High*, Issuer,*Date*
Scatter Plot Price *Open vs Low* And *High*	The range of price increases from the point*Open* the *High*.	Measures the potential daily price increase from the opening.	*Open*, *High*, Issuer,*Date*
*Heatmap*Volatile Issuers	Correlation matrix of issuer price & volatility against time.	Identifying momentum patterns and periodic (monthly) trends.	*High*, *Low*, Issuer,*Date*

Deployment

At the level *deployment*development is carried out*dashboard*based on the design of the modeling and also*dashboard design pattern*. Plan *dashboard design pattern*can be seen in Table 2.

Table 2. Dashboard Design Pattern

Category	Patterns used
Data Information	*Aggregated Data, Detailed Datasets*
Structure	*Hierarchical*
Visual Representation	*Detailed Charts, Tables*
Page Layout	*Open Layouts*
Screen Space	*Multiple Page, Overflow*
Interaction	*Filter and Focus*
Color	*Encoding*

Here is a further explanation:

- *Data Information*, *Dashboard*It begins with aggregate data visualization to show general trends, then continues with detailed analysis per issuer using graphs such as line charts, box plots, and scatter plots.
- *Structure*, Using a hierarchical structure between pages, where the results of the initial visualization such as*box plot*used to determine the focus of further analysis.

- *Visual Representation*, Combining detailed graphics (*line chart*, scatter *plot*, *box plot*) And *heatmap*color table based to display stock trend, distribution and performance information.
- *Page Layout*, Adopt*open layout*, each page contains a specific visualization without rigid layout constraints for display flexibility.
- *Screen Space*, Apply *multiple page* And *overflow scrolling*so that each page focuses on one topic of analysis, while allowing access to additional information through*scroll*.
- *Interaction*, Equipped with features*filter*based on issuer categories and time ranges to filter relevant data according to visualization needs.
- *Color*, The color scheme is used as a medium*encoding*, helps differentiate data between issuers and speeds up the reading of visual information.

Appearance *Dashboard*

Here is the view*dashboard* which has been made in accordance with the plan from *modelling* And *dashboard design pattern*

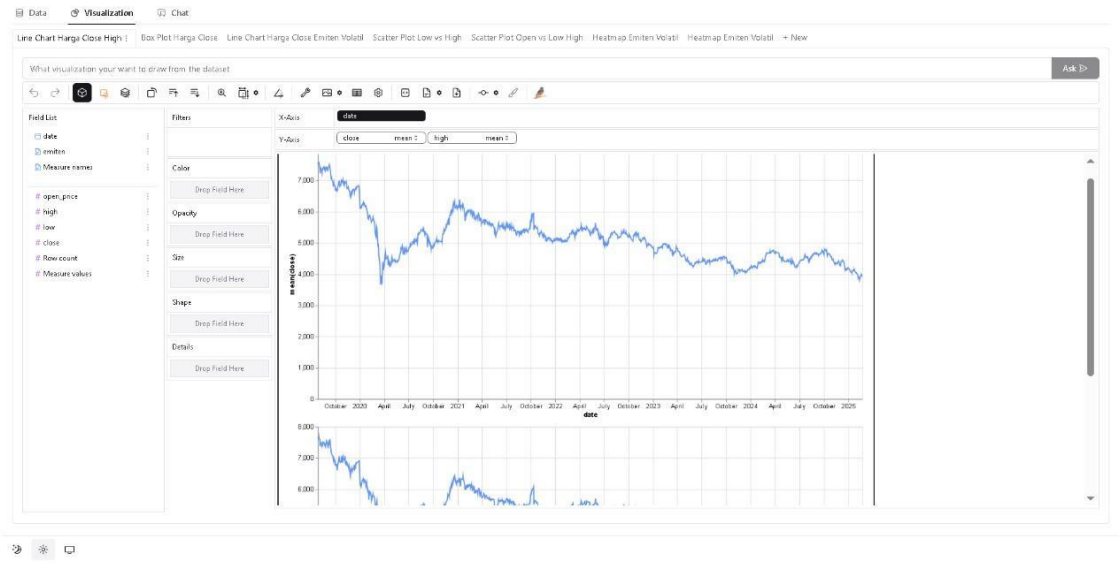

Figure 2. *Dashboard*Page 1

On Page 1, as shown in Figure 2, the use of*Data Information* which is *Aggregated Data* through *Line Chart*to present the average closing price (*close*) all stocks during the 2019–2025 period. The trend in the average closing and high prices of LQ45 stocks over time is successfully displayed through this dashboard. Using the time axis and the average closing and high prices of all stocks in the LQ45 index, users can observe the general market movement during 2019–2025.

Figure 3. *Dashboard*Page 2

For page 2 in Figure 3 also used properties *Aggregated Data*. Used by *Box Plot*This visualization provides an overview of the distribution and range of closing price movements for each stock. This visualization successfully demonstrates the distribution and spread of stock prices for each issuer.*Box plot*displays the median, quartiles, and*outlier*, making it easier for users to compare stability between stocks.

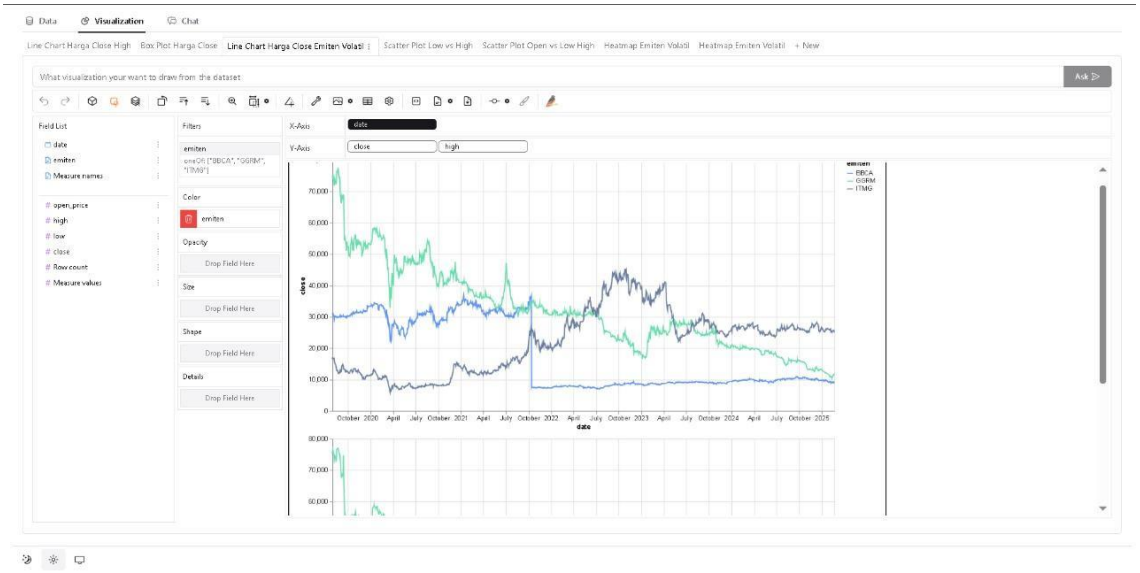

Figure 4. *Dashboard*Page 3

Next on page 3 the principle of structure is used*Hierarchical*the use of selected issuers obtained from*Box Plot*based on the highest volatility level of the closing price. On this page there is also the use of*Detailed Datasets*by using visualizations that focus on the close price and*high*The three stocks with the highest volatility from 2019 to 2025, as seen in Figure 4. This chart successfully compares the price trends of the three most volatile issuers. The color-coded price lines help users see and compare the price dynamics of the three stocks.

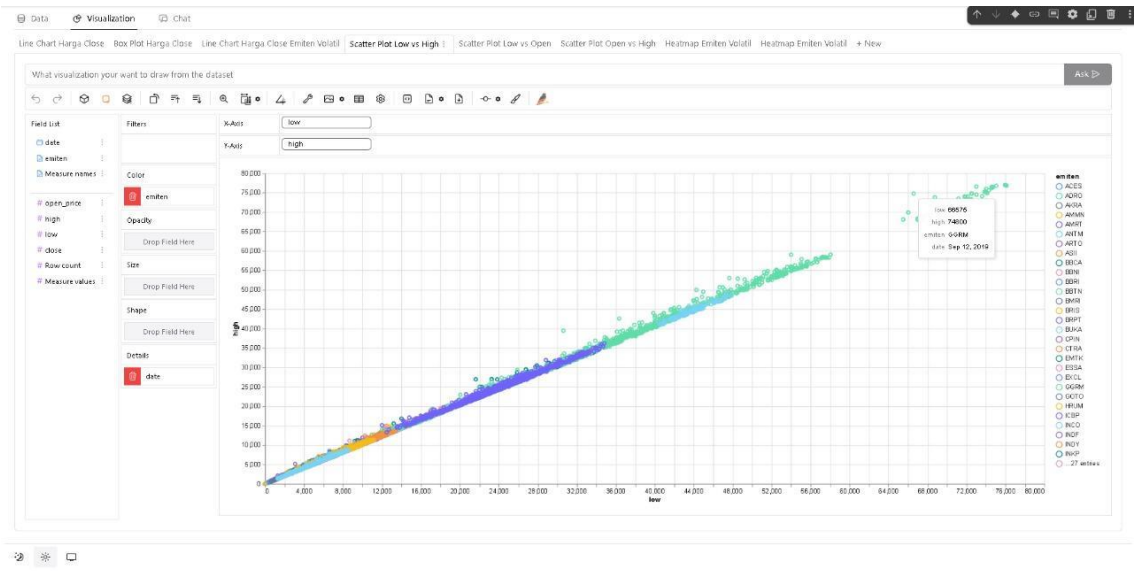

Figure 5. *Dashboard*Page 4

On page 4, the approach used*detailed datasets*to display a volatility visualization that focuses on price fluctuations within a single trading day. This visualization, as shown in Figure 5, shows the difference between the highest and lowest prices within a single session. This presentation aims to identify issuers experiencing the most significant daily price fluctuations. Points spread far from the diagonal line indicate high levels of volatility on specific days. Thus, this distribution pattern allows users to identify days with extreme price movements and issuers exhibiting high market dynamics.

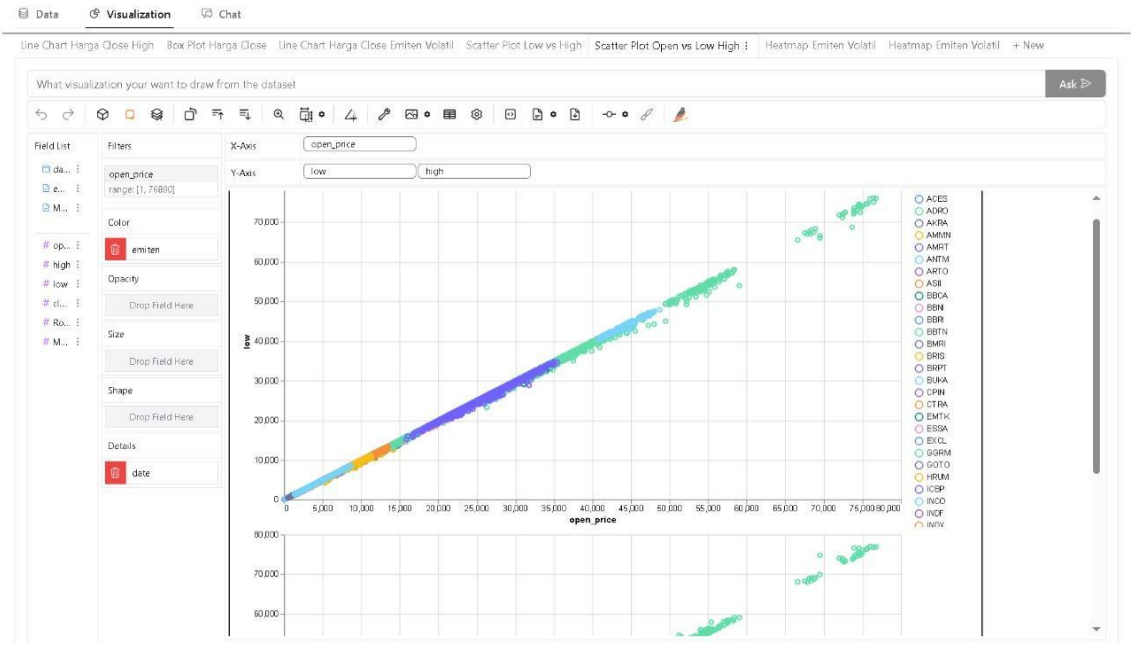

Figure 6. *Dashboard*Page 5

Meanwhile, page 5 displays a visualization with an approach*detailed datasets*, but using a different variable, namely the difference between the opening price and the highest and lowest prices within a single day. Figure 6 shows how a stock's price can move from its opening point to both its daily maximum and minimum values. This visualization

provides a comprehensive overview of the potential price direction during each trading session. By examining the relationship between the points, users can evaluate the range of possible price increases and decreases, as well as assess the level of risk and opportunity inherent in each issuer in the context of daily fluctuations.

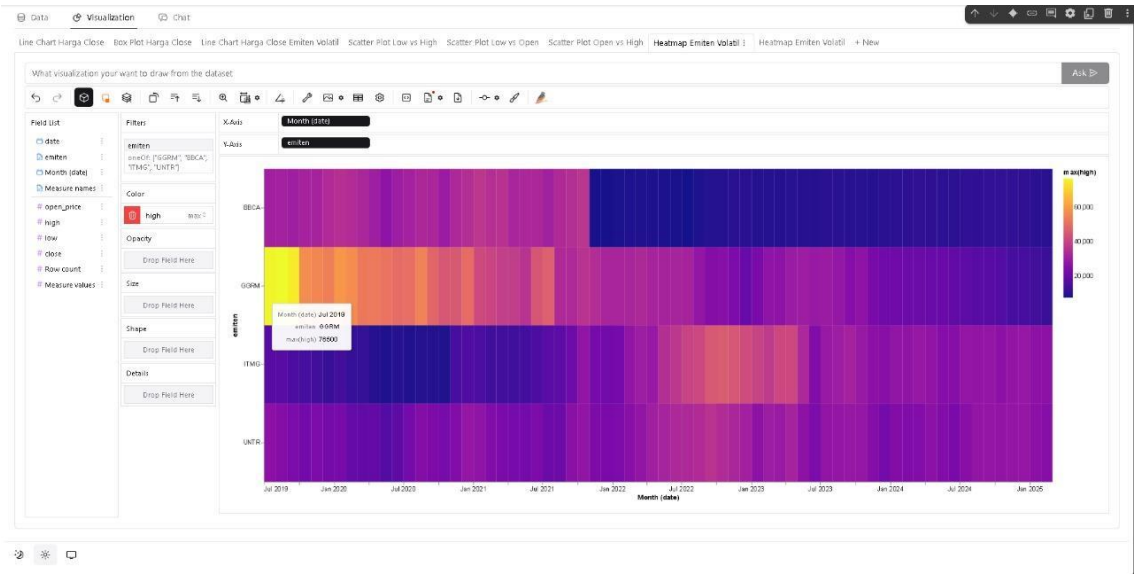

Figure 7. *Dashboard*Page 6

On page 6, it is shown*heatmap*which represents aggregated monthly peak price data, as seen in Figure 7. This visualization is created by aggregating daily data into monthly maximum values for each issuer. The goal is to display the periodic peak price movement pattern, allowing users to observe seasonal trends and identify periods with significant price spikes. The color variations in*heatmap*serves as a visual indicator that facilitates interpretation of the rate of price increase on a monthly time scale.

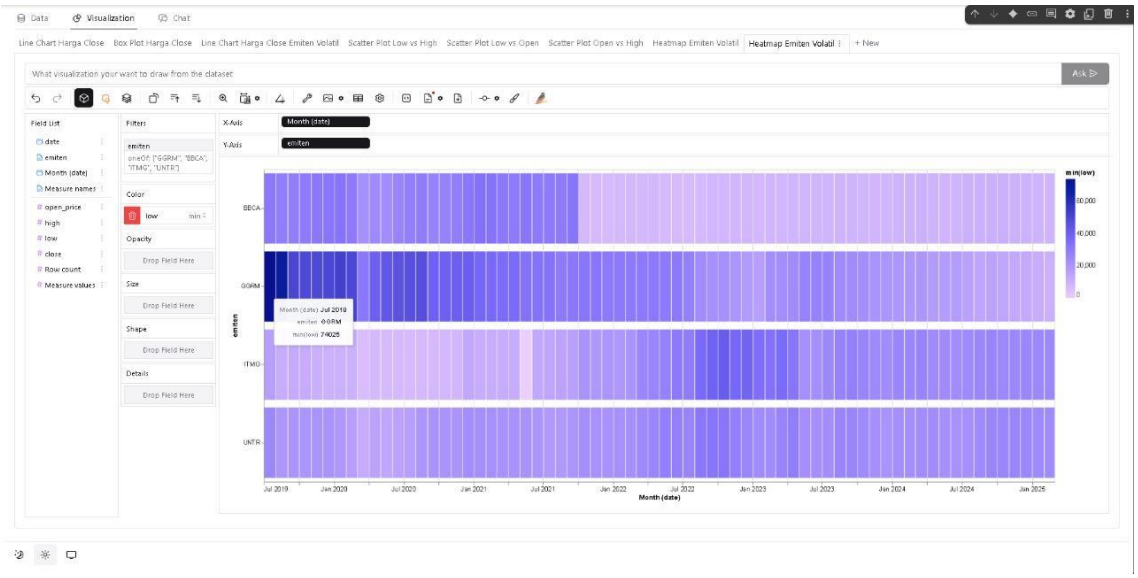

Figure 8. *Dashboard*Page 7

Meanwhile, page 7 displays a similar heatmap, focusing on monthly lows, as shown in Figure 8. The data used is the aggregation of the minimum daily price values for each

month. This visualization aims to reveal recurring patterns of price declines and detect periods of significant price pressure. As on page 7, color gradations are used to depict the intensity of the lows, allowing for a more comprehensive analysis of long-term movement patterns.

EVALUATION

After the manufacturing process*dashboard*Once completed, the next stage is to conduct a user evaluation. This evaluation is conducted using an instrument in the form of a questionnaire distributed online via the platform.*Google Form*.

Through this questionnaire, it is hoped that assessments and input can be obtained regarding several important aspects, such as visual appearance, ease of use, and level of understanding of the information presented in the dashboard.

The percentage range of the Likert Scale can be seen in Table 3, while the recapitulation of user assessment results is shown in Table 4.

The response scale used is as follows:

- 1: Strongly Disagree / Never
- 2: Disagree / Rarely
- 3: Neutral / Sometimes
- 4: Agree / Often
- 5: Strongly Agree / Very Often

Table 3. Likert Scale Range

Interval	Criteria
0%-29.99%	Very bad
20%-39.99%	Bad
40%-59.99%	Neutral
60%-79.99%	Good
80%-100%	Very good

Table 4. Questionnaire Results

No.	Question	Distribution of Answers					Shoes Total	Percentage
1.	How often do you follow stock price movements?	3	3	6	2	4	55	61.11%
2.	This dashboard interface is easy to navigate.	0	1	1	6	10	79	87.78%
3.	The dashboard page is easy to understand and use.	0	0	3	8	7	76	84.44%
4.	The information displayed in the visualization is clear.	0	0	1	6	11	82	91.11%
5.	*Dashboard* this helps in understanding the movement of the LQ45 share price.	0	0	2	3	13	83	92.22%
6.	Display design*dashboard*looks attractive and comfortable to use.	0	0	5	7	6	73	81.11%

7.	*Dashboard*looks neat and not confusing.	0	1	0	8	9	79	87.78%
8.	*Dashboard*It provides relevant and useful visualization features.	1	0	2	3	12	79	87.78%
9.	The type of visualization used is appropriate for depicting the information.	0	0	0	5	13	85	94.44%

CONCLUSION

This research successfully achieved its primary objective, which was to build an interactive dashboard that presents descriptive data visualizations related to stock price movements in the LQ45 index. The visualizations were developed with the assistance of*PygWalker*able to display graphs and data summaries for stock price trends and distributions based on a certain period in*dataset*historical.

With the implementation of*CRISP-DM* (*Cross Industry Standard Process for Data Mining*) as the main framework, as well as the planning pattern *Dashboard Design Pattern*as a reference in compiling the interface display, the process of processing historical data to presenting visualizations can be done in a structured and systematic manner.

Based on the evaluation results obtained through questionnaire distribution, user satisfaction levels indicated that most aspects were rated "Good" to "Very Good." This indicates that the visual appearance is satisfactory.

Development*dashboard*Descriptive data visualization of LQ45 stock price movements can still be done by adding data presentation features.*real-time*, so the need for more up-to-date price monitoring can be met, as with professional trading platforms. This way, the information presented will be more relevant and support faster decision-making.

Additionally, improvements to display elements are also noteworthy, such as the addition of clearer titles and axis labels with units, as well as the use of currency format (Rupiah) in number visualizations. These adjustments are expected to improve information clarity and ease of interpretation for users from various backgrounds.

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