**Cryptocurrency Market & Transaction Analysis**

## **1. Introduction**

This project analyzes **real-time cryptocurrency market data** using **SQL**. It provides insights into price trends, market volatility, trading volume, and key financial metrics. We collected data using the CoinGecko API and stored it in PostgreSQL, enabling advanced queries and financial analysis.

## **2. Data Collection & Storage**

2.1 Data Source

* **API Used:** CoinGecko API (Public, free tier)
* **Data Type:** Real-time cryptocurrency market data

2.2 Database Setup

* **Database:** PostgreSQL (Managed via pgAdmin)
* **Imported Tables & Columns:**
  1. **cryptocurrencies** → Stores basic information about each cryptocurrency
     + coin\_id, name, symbol, market\_cap\_rank
  2. **coin\_prices** → Stores price and market metrics
     + coin\_id, current\_price, market\_cap, total\_volume, price\_change\_24h
  3. **coin\_supply** → Stores coin supply details
     + coin\_id, total\_supply, circulating\_supply
  4. **historical\_prices** → Stores daily historical price changes
     + coin\_id, date, price, market\_cap, total\_volume

2.3 Data Import Process

1. Fetched data using CoinGecko API
2. Transformed JSON data into structured tables
3. Imported data into PostgreSQL using pgAdmin & SQL scripts
4. Performed data cleaning & transformation

## **3. Data Cleaning & Transformation**

* Removed **null values** and **duplicate records**
* Standardized **data types** (converted numeric values from strings)
* Created **custom columns** for better insights:
  + **Price Change (%)** → (price\_change\_24h / (current\_price - price\_change\_24h)) \* 100
  + **Market Liquidity Ratio** → total\_volume / market\_cap
  + **Rolling Average Price (7 Days)** → Used **window functions** for smooth trend analysis

## **4. Data Analysis & SQL Queries**

#### 4.1 Basic Cryptocurrency Information

* Retrieved the list of all available cryptocurrencies along with their coin\_id, name, and symbol.
* Queried real-time cryptocurrency prices to monitor market trends.
* Identified the **top 5 cryptocurrencies** with the highest market capitalization.
* Analyzed **latest price changes** in the last 24 hours, including percentage changes and timestamps.
* Determined the **total number of cryptocurrencies** available in the dataset.

**4.2 Market Trends & Supply Analysis**

* Calculated the **average daily price change** across all cryptocurrencies.
* Identified the cryptocurrency with the **highest market capitalization**.
* Retrieved the **top 10 cryptocurrencies** based on **circulating supply**.
* Examined the relationship between **market cap change** and **price change**, specifically for coins with a **price increase above 5%**.
* Identified cryptocurrencies with a **market cap exceeding $1 billion**.

**4.3 Historical Performance & All-Time Highs**

* Found the cryptocurrency with the **maximum and minimum max\_supply**.
* Listed the **top 5 cryptocurrencies with the highest price gains** in the last 24 hours.
* Merged market and supply data to analyze **current price, circulating supply, and all-time high (ATH)** for each coin.
* Identified the cryptocurrency with the **highest ATH value and its ATH date**.
* Calculated the **market cap per unit of supply**, helping in evaluating the value distribution.

**4.4 Time-Series & Volatility Analysis**

* **7-day & 30-day rolling averages** were computed to analyze price trends.
* Identified the **top 5 most volatile cryptocurrencies** over the last 30 days.
* Measured **7-day price volatility** for each cryptocurrency.
* Calculated the **correlation between price and total volume** over the last 30 days.
* Found cryptocurrencies with **strongest positive & negative correlations** between price and market capitalization.

**4.5 Whale Movements & Anomalies**

* Detected **large transactions (whale movements)** by identifying significant deviations from average volume.
* Identified coins that experienced **sudden abnormal price changes** exceeding **10% in a single day**.

## **5. Insights & Findings**

* Bitcoin and Ethereum consistently rank as the top two cryptocurrencies in terms of market capitalization.
* Market trends show significant price volatility, especially during major news events or regulatory updates.
* Whale movements (large transactions) often impact short-term price fluctuations, indicating their influence on market trends.
* Certain altcoins show strong growth trends, which can be useful for identifying potential investment opportunities.
* The highest trading volumes are observed during specific time intervals, correlating with major global financial market openings.

## **6. Challenges & Limitations**

* **API Limitations:** The CoinGecko API has a rate limit (~30 calls per minute), requiring careful request optimization.
* **Data Gaps:** Some cryptocurrencies have missing data due to irregular API updates or delistings from exchanges.
* **Query Complexity:** Handling time-series data in SQL required advanced techniques like window functions and recursive queries.
* **Storage Considerations:** Large datasets with frequent updates demand an efficient indexing strategy for better query performance.
* **Real-time Updates:** The current setup does not support fully real-time data updates, which is crucial for high-frequency trading insights.

## **7. Conclusion**

This project successfully demonstrates how SQL can be used to analyze cryptocurrency market trends, transaction patterns, and price movements. By utilizing real-world data from the CoinGecko API, we extracted valuable insights into market capitalization, trading volume, price fluctuations, and whale activity. The structured queries provided valuable financial analytics, which can benefit traders, investors, and data analysts in making informed decisions. Future enhancements, including automation and predictive modeling, will further improve the project's scope and applicability in the financial industry.

This analysis can assist investors, researchers, and analysts in making data-driven financial decisions in the volatile cryptocurrency market.