Cryptocurrency Liquidity Prediction for Market Stability

# 1. High-Level Design (HLD)

Project Title: Cryptocurrency Liquidity Prediction for Market Stability

Objective: Develop a machine learning model to predict the liquidity level of cryptocurrencies using market metrics like price, volume, volatility, and market cap — to help traders and institutions manage risks.

System Components:

* - Data Source: Historical CoinGecko data (2016–2017 sample)
* - Preprocessing Layer: Missing value handling, scaling
* - Feature Engineering: Liquidity ratios, volatility indicators
* - ML Model: Random Forest Regressor
* - Evaluation Layer: MAE, MSE, R²
* - Deployment Layer: Streamlit app for input + prediction

# 2. Low-Level Design (LLD)

Preprocessing:

* - Drop rows with nulls
* - Convert relevant columns to numeric
* - Normalize features with StandardScaler

Feature Engineering:

* - volume\_to\_mktcap = 24h\_volume / market\_cap
* - volatility\_24h = abs(24h\_change)
* - volatility\_7d = abs(7d\_change)

Model Architecture:

* - Model: RandomForestRegressor(n\_estimators=100, max\_depth=4)
* - Input Features: Scaled versions of price, 1h/24h/7d changes, volume, market cap, volatility
* - Target: volume\_to\_mktcap

Evaluation:

* - MAE ≈ 0.0368
* - MSE ≈ 0.00604
* - R² ≈ 0.596

# 3. Pipeline Architecture

Raw CSV Files (CoinGecko)  
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Data Cleaning (missing values, type conversion)  
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Feature Scaling (StandardScaler)  
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Feature Engineering (liquidity + volatility features)  
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Train-Test Split (80-20)  
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Model Training (Random Forest)  
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Evaluation (R², MAE, MSE)  
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Deployment (Streamlit App)

# 4. Final Report Summary

We processed real cryptocurrency data with price, volume, and volatility metrics.  
Built a Random Forest Regressor to predict liquidity ratio (volume\_to\_mktcap).  
Achieved ~60% R² score, showing strong baseline performance.  
Deployed the model using a Streamlit app that accepts real-time inputs and returns predictions.  
The system can help detect liquidity crunches, improving decision-making in volatile markets.