**Cryptocurrency Liquidity Prediction for Market Stability**

– High Level Design (HLD)

Domain: Machine Learning, Financial Analytics

Project Name: Cryptocurrency Liquidity Prediction System

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# 1. Purpose

The purpose of this High Level Design (HLD) document is to provide a structured overview of the Cryptocurrency Liquidity Prediction System. It outlines the key modules, data flow, model integration, user interaction, and deployment infrastructure. The system provides predictive insights into the liquidity ratio of cryptocurrencies using market-driven features.

# 2. Functional Overview

The system predicts a cryptocurrency's liquidity ratio and classifies it as Low, Medium, or High based on key indicators such as price changes, trading volume, and market capitalization. The functionality is accessed through a user-friendly web interface backed by a Flask-based ML API hosted on Render.

Core Functionalities:

- Accept user inputs related to crypto asset features

- Perform predictions using a trained ML model

- Classify the liquidity status (Low/Medium/High)

- Present results on a web interface

# 3. Modules and Components

Frontend: HTML + Jinja2 template form for user input

Flask Backend: Python-based server routing for prediction and rendering

Model Loader: Loads the joblib serialized stacking model

Prediction Logic: Applies input transformation, prediction, expm1 inverse-transform

Classification Unit: Applies business rules to determine liquidity class

Render Deployment: Cloud hosting environment for real-time prediction

# 4. High Level Architecture Diagram

User Input Form

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Flask App (app.py)

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Model Prediction (joblib)

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Liquidity Ratio (expm1 of log)

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Liquidity Classification Logic

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Web Result Page (HTML)

# 5. Technology Stack

Frontend: HTML, CSS, Jinja2

Backend: Flask (Python)

ML Library: scikit-learn, xgboost

Deployment: Render

Model Storage: joblib (.pkl)

# 6. Assumptions and Constraints

- Only numeric inputs are allowed via the form

- The model expects 7 specific features

- No user authentication implemented

- System assumes model file and code are version-matched

# 7. Performance Metrics

MAE: 0.00836

RMSE: 0.01932

R² Score: 0.95221

# 8. Conclusion

This High Level Design (HLD) lays the foundation for understanding the architecture and module interactions in the Cryptocurrency Liquidity Prediction System. The modular design ensures maintainability, and cloud deployment provides real-time access. This design enables seamless user interaction with powerful machine learning capabilities behind the scenes.