Features

🟦 A. PORTFOLIO FEATURES (Business Logic / Application Layer)

1. User Portfolio Management

- Add assets (stock/ETF/crypto)
- Track quantity, price, gains/losses

MODEL:

- Pure backend logic (no ML, no math)

🟩 B. TREND ANALYSIS (Analytics Layer)

2. Technical Indicators

Indicators:

- SMA / EMA
- RSI
- MACD
- Volatility (std deviation)

MODEL TYPE: Mathematical

- Best choice: **Mathematical formulas**
- Reason: Indicators are deterministic and standard.

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3. Trend Classification

Primary Method (Best: Mathematical Rule-Based)

- Trend = slope(SMA)
- If price > SMA & MACD > 0 → Uptrend
- If price < SMA & MACD < 0 → Downtrend

Optional (Secondary ML Method)

- Logistic Regression or Random Forest with:
  - RSI
  - MACD
  - Momentum
  - Volume change

Default Choice:
→ **Mathematical classification** (more stable + simpler + transparent)

ML is optional.

🟧 C. PRICE PREDICTION MODULE (ML Layer)

4. Short-Term Price Forecasting (Core ML Component)

Models Used (Best Choice Combination):

1. **ARIMA (Mathematical time-series model)**
   - Works best for stationary parts of data
2. **LSTM / GRU (ML neural network)**
   - Captures nonlinear and sequential patterns

Why both?

- ARIMA → interpretable, fast
- LSTM → handles complex patterns

Application uses whichever performs better per asset.

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5. Volatility Prediction

Models Used:

1. **GARCH (Mathematical volatility model)** → best for volatility
2. **Random Forest Regression (ML)** → if data is nonlinear

Default: GARCH

🟥 D. RISK ANALYSIS MODULE (Analytics Layer)

6. Portfolio Risk Score

- Based on variance, covariance, exposure

Models Used: Mathematical

- Portfolio variance formula
- Correlation matrix
- Standard deviation

Best choice: **math models** (finance uses them universally)

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7. Value-at-Risk (VaR)

Two methods:

Models Used: Mathematical

1. **Historical VaR (simple & practical)**
2. **Variance–Covariance VaR (parametric)**

Best choice: Math ≫ ML
ML is unnecessary for VaR.

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8. Risk Alert Engine

- Monitor VaR
- Monitor volatility
- Monitor loss %

Models Used:

- Rule-based thresholds (mathematical, simple logic)

🟦 E. RECOMMENDATION MODULE (ML + Math Hybrid)

9. Asset Ranking (ML Component)

Model Used:

- **Random Forest Regression** or **XGBoost**
  Features:
- Past volatility

- Momentum
- Previous returns
- ML-predicted return
- Trend classification

Output:

- A score (0–1) for each asset.

Reason:
ML performs well at ranking because it's nonlinear.

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10. Portfolio Allocation (Math Component)

Model Used: Modern Portfolio Theory (MPT)

- Maximize Sharpe ratio
- Mean-variance optimization
- Minimize risk for a target return

Best choice: **Mathematical optimization**
→ Industry standard, more reliable than ML.

🟫 F. NOTIFICATION SYSTEM (Application Layer)

11. Email Alerts

Triggered when:

- VaR > user tolerance
- Loss > threshold
- Volatility spike detected

Models Used:

- Simple rule-based system (no ML)

🟩 G. BACKTESTING MODULE (Analytics + ML Layer)

12. Backtesting

- Test prediction models
- Test MPT performance
- Test trend strategy

Models Used:

- Rolling window backtesting
- RMSE, MAE for forecasting
- Sharpe ratio for portfolio
- Hit ratio for trend
- Cumulative returns