CRYPTO VOLATILITY AND RISK ANALYZER

(CVARA)

****INFOSYS SPRINGBOARD FINAL PROJECT****

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Introduction

Cryptocurrency markets are highly volatile and unpredictable. Investors and analysts require systematic tools to measure risk, analyze price behavior, and make informed decisions.

*This project presents an end-to-end crypto risk analytics system that:

- Collects live crypto data
- Computes statistical risk metrics
- Visualizes trends
- Classifies assets into risk categories

Project Overview

- The project “Crypto Volatility and Risk Analyzer” aims to analyze and visualize the volatility patterns of selected cryptocurrencies to estimate their risk levels over time.
- The system fetches real-time and historical cryptocurrency data from APIs such as CoinGecko and performs quantitative analysis to measure volatility, Sharpe ratio, and beta coefficients.
- Using data analytics and visualization libraries in Python (like Matplotlib and Plotly), this project will generate interactive visual dashboards that display risk insights.
- The tool will ultimately help traders, investors, and researchers identify high-risk and low-risk cryptocurrencies through dynamic and data-driven visual analysis.

Project Workflow

```
Home Page
   ↓
Milestone 1: Data Collection
   ↓
Milestone 2: Volatility Analysis
   ↓
Milestone 3: Risk Metrics
   ↓
Milestone 4: Risk Classification & Dashboard
```

- CVARA is a crypto risk and volatility analysis tool
- Designed with milestone-based development
- Each milestone represents a functional module
- Integrated using a centralized Home Page

Purpose

- To analyze cryptocurrency market volatility
- To calculate risk metrics such as volatility and Sharpe ratio
- To visualize price trends and risk–return behavior
- To classify cryptocurrencies into High, Medium, and Low risk categories
- To provide a decision-ready analytical dashboard

LOGIN PAGE

- **User Authentication Module :**
  - **Secure login interface for CVARA application**
  - **Implemented using a clean and modern UI**
  - **Ensures authorized access to analytics features**

Database Integration

01 Backend connected to SQLite database

02 Stores user credentials securely

03 Supports user registration and login validation

- Purpose
  - Protects application from unauthorized access
  - Enables personalized and controlled usage
  - Prepares the system for future scalability (user roles, history, preferences)

Output :-


CVARA
Crypto Volatility & Risk Analyzer
Login
Email
Password
Submit
New user? Register

HOME PAGE

- **Home Page Overview:**
  - **The Home Page serves as the central entry point of the CVARA application**
  - **It provides a single, unified interface to access all project functionalities**
  - **Designed to ensure clarity, simplicity, and ease of navigation**

Features:

01
- Acts as the main navigation hub for the application

02
- Provides dedicated links to all four milestones

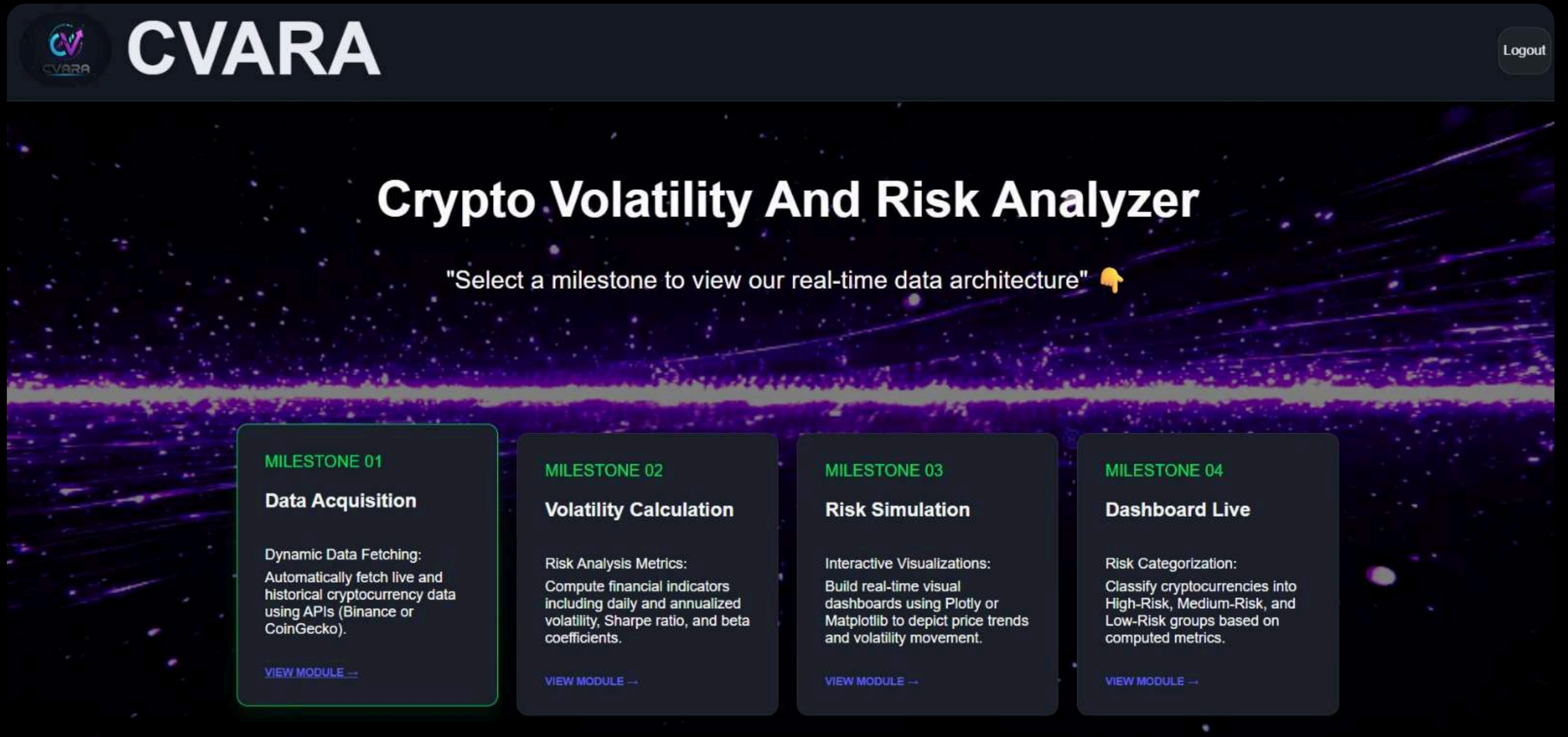
03
- Allows users to move between modules without restarting the application

04
- Maintains a clean, minimal, and user-friendly layout

- Purpose:

To organize project functionalities in a structured manner.

Output :-


CVARA
Logout
Crypto Volatility And Risk Analyzer
"Select a milestone to view our real-time data architecture" 👇
MILESTONE 01
Data Acquisition
Dynamic Data Fetching:
Automatically fetch live and historical cryptocurrency data using APIs (Binance or CoinGecko).
VIEW MODULE →
MILESTONE 02
Volatility Calculation
Risk Analysis Metrics:
Compute financial indicators including daily and annualized volatility, Sharpe ratio, and beta coefficients.
VIEW MODULE →
MILESTONE 03
Risk Simulation
Interactive Visualizations:
Build real-time visual dashboards using Plotly or Matplotlib to depict price trends and volatility movement.
VIEW MODULE →
MILESTONE 04
Dashboard Live
Risk Categorization:
Classify cryptocurrencies into High-Risk, Medium-Risk, and Low-Risk groups based on computed metrics.
VIEW MODULE →

Milestone_1

- Objective:
  - To fetch live and historical cryptocurrency price data.

- Key Activities:
  - Python environment setup
  - API integration (CoinGecko)
  - Automated data fetching
  - Missing value handling
  - Cryptocurrencies Used:
    - Bitcoin, Ethereum, Solana, Cardano, Dogecoin

How Milestone 1 Works ?

- Fetches live and historical cryptocurrency price data using APIs
- Extracts timestamp and closing price values
- Converts raw API responses into structured time-series format
- Handles missing values and duplicate records
- Supports automatic data refresh for real-time updates

Output:

✓ Clean and reliable price dataset ready for risk analysis

Benefits of Milestone 1

- Provides a strong and reliable data foundation
- Enables real-time market monitoring
- Eliminates manual data collection
- Ensures consistency across all milestones
- Scalable for adding more cryptocurrencies

Significance:

✓ Milestone 1 forms the backbone of the entire crypto risk analytics system.

Output :-

HOME

Milestone 1: Data Acquisition

Requirements

- Environment Setup (Flask & Python libraries)
- API Integration (CoinGecko)
- Data Storage (SqLite Database)
- Preprocessing missing values

Outputs

- Daily price data for 5+ cryptocurrencies
- Verified API connectivity & data consistency

7-Day Price Trend

Live Crypto Market Feed

Refresh

✓ Updated successfully

Last Updated: 27/1/2026, 7:35:31 pm

Cryptocurrency	Price (USD)	24h Change	Volume
Bitcoin (BTC)	$87,874	0.03%	$40,12,00,02,004
Ethereum (ETH)	$2,909.07	0.08%	$23,41,37,78,164
Solana (SOL)	$123.09	0.04%	$3,74,44,53,423
Cardano (ADA)	$0.348	-0.19%	$40,37,16,049
Dogecoin (DOGE)	$0.122	0.00%	$87,33,09,794
Litecoin (LTC)	$68.97	0.79%	$36,37,59,101
Polkadot (DOT)	$1.84	-1.02%	$9,92,23,391
TRON (TRX)	$0.293	-0.50%	$46,45,79,923
Chainlink (LINK)	$11.85	-0.24%	$26,12,99,099

Milestone_2

- Objective:
  - To process raw price data and compute risk metrics.

- Key Calculations Performed
  - Logarithmic daily returns
  - Volatility (risk measurement)
  - Sharpe Ratio (risk-adjusted return)
  - Beta (relative risk compared to benchmark)
- Input:

  Clean time-series price data from Milestone 1

Metrics Generated

- Volatility: Measures price fluctuation intensity
- Sharpe Ratio: Evaluates return per unit of risk
- Beta: Indicates sensitivity to market movements

Advantages of Milestone 2

- Converts raw data into actionable risk insights
- Enables comparison between different cryptocurrencies
- Supports informed investment decision-making
- Provides inputs for visualization and classification

Output :-

HOME

Milestone 2: Data Processing

Requirements

- Daily returns calculation
- Statistical measures computation
- Moving average implementation

Outputs

- Metrics table with risk indicators
- Processed dataset for visualization

Crypto Comparison

Volatility Sharpe Beta VaR

Risk Metrics Dashboard

• Analysis

30D 90D 1Y Refresh

✓ Data updated successfully

Last Updated: 27/1/2026, 7:36:52 pm

Crypto	Volatility	Sharpe	Beta	VaR
BTC	32.55%	0.06	1.04	2.55%
ETH	52.88%	-0.13	1.54	4.53%
SOL	53.36%	-0.21	1.45	3.26%
ADA	79.26%	-0.54	2.05	5.17%
DOGE	77.82%	0.02	1.89	4.87%
XRP	71.62%	0.25	0.51	4.91%
LTC	48.68%	-3.71	0.12	4.53%
DOT	81.89%	-0.26	0.86	5.17%
TRX	31.35%	1.25	0.1	2.32%
LINK	55.9%	-0.96	0.45	4.79%

Milestone_3

- Objective:
  - To visually analyze crypto price behavior and risk trends.

- Visualizations Implemented:
  - Price Trend Charts:
    - Display historical price movements to identify trends and market direction
  - Volatility Trend Charts:
    - Highlight fluctuations and instability in cryptocurrency prices over time
  - Risk–Return Scatter Plots:
    - Compare cryptocurrencies based on risk versus expected return

Key Activities

- Time-series visualization of crypto prices
- Volatility trend analysis using rolling windows
- Risk–return relationship visualization
- Multi-cryptocurrency comparison using interactive charts

Input: Processed risk metrics from Milestone 2

Advantages of Milestone 3

- Makes complex risk metrics easy to understand
- Enables quick identification of volatile assets
- Improves decision-making through visual insights
- Provides a professional, user-friendly analytical dashboard

Output :-

HOME

Milestone 3 : Visualization Dashboard

Requirements

- Interative Visualisation (plotly)
- Dashboard development(dash)
- Time Series Graph for price/volatility
- Risk-return plots and comparisons

Outputs

- Interaction Dasboard with risk metrics
- Responsive UI with filters/selection

✓ Dashboard Features

Crypto Risk Analytics Dashboard

• Analysis

Bitcoin × Ethereum × Solana × Cardano × Dogecoin

2025-12-28 →

2026-01-27

HOME

Requirements

- Interative Visualisation (plotly)
- Dashboard development(dash)
- Time Series Graph for price/volatility
- Risk-return plots and comparisons

Outputs

- Interaction Dasboard with risk metrics
- Responsive UI with filters/selection

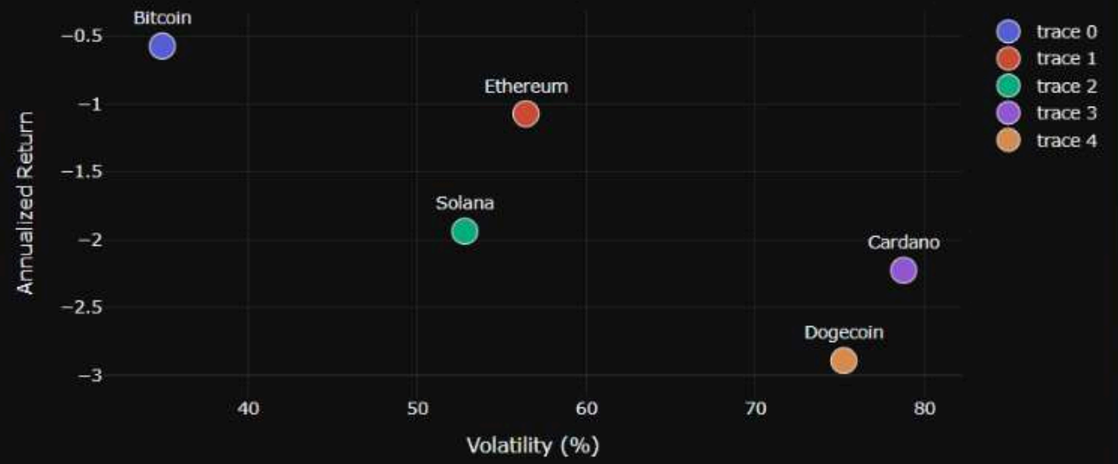
✓ Dashboard Features

Crypto Risk Analytics Dashboard

• Analysis

Solana Price
Solana Volatility
Cardano Price
Cardano Volatility
Dogecoin Price
Dogecoin Volatility

Risk–Return Analysis



59.62%	-2.85	1.57	Medium
Avg Volatility	Avg Sharpe	Beta vs BTC	Risk Level

Milestone_4

- Objective:
  - To summarize analysis results and present them in a clear, decision-ready format.

- Key Features:
  - Risk Distribution Summary:
    - Displays how cryptocurrencies are distributed across risk categories
  - Risk-Level Visualization:
    - Graphical representation of low, medium, and high-risk assets
  - Exportable Reports (CSV):
    - Allows users to download analytical results for further use

Input : Processed risk metrics from Milestone 2 & visual insights from Milestone 3

Risk Classification Logic

- High Risk: Cryptos with highest volatility
- Medium Risk: Moderately volatile assets
- Low Risk: Relatively stable cryptocurrencies

(Classification based on recent volatility trends)

Advantages of Milestone 4

- Simplifies complex risk data into clear categories
- Helps investors quickly identify high-risk assets
- Supports strategic investment decisions
- Completes the end-to-end crypto risk analysis pipeline

Output :-


HOME
Milestone 4: Risk Classification & Reporting
Requirements
Risk thresholds for classification
Visual highlighting of high-risk assets
Summary reports (CSV / PDF)
System validation & documentation
Outputs
Complete dashboard with risk classification
Categorized risk report
Deployment & documentation guide
Project Completion Status
100
80
60
40
20
0
M1
M2
M3
M4
Risk Classification Dashboard
Analysis
Bitcoin (BTC)
Ethereum (ETH)
Solana (SOL)
Cardano (ADA)
Dogecoin (DOGE)
Refresh
CSV
PDF
Last update: 19:39:20
High Risk
CARD : 79.26%
DOGE : 77.82%
Medium Risk
ETHE : 52.88%
SOLA : 53.36%
Low Risk
BITC : 32.55%
Risk Summary Report
Total Cryptocurrencies: 5
Average Volatility: 59.17%
2 High / 2 Medium / 1 Low
40%
40%
High
Medium
Low

HOME

Requirements

- Risk thresholds for classification
- Visual highlighting of high-risk assets
- Summary reports (CSV / PDF)
- System validation & documentation

Outputs

- Complete dashboard with risk classification
- Categorized risk report
- Deployment & documentation guide

Project Completion Status

Risk Classification Dashboard

• Analysis

High Risk

CARD : 79.26%

DOGE : 77.82%

Medium Risk

ETHE : 52.88%

SOLA : 53.36%

Low Risk

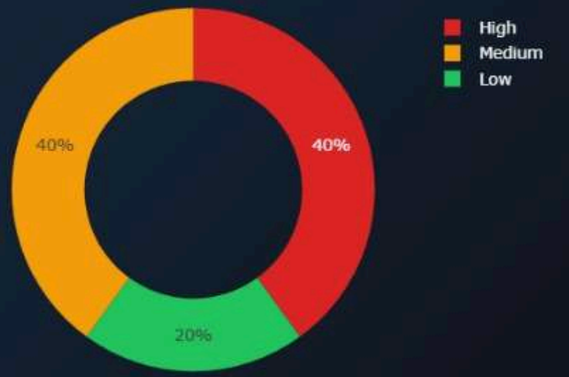
BITC : 32.55%

Risk Summary Report

Total Cryptocurrencies: 5

Average Volatility: 59.17%

2 High / 2 Medium / 1 Low



Conclusion

Successfully implemented an end-to-end crypto risk analytics system

Integrated data collection, processing, visualization, and classification

Developed a professional, scalable, and interactive dashboard

Enables informed decision-making in volatile crypto markets

✓ **All project milestones successfully completed**

Future Scope of the Project

- **Machine Learning Integration**
  Incorporate ML models (LSTM, Random Forest) to predict future volatility and price trends.
- **Real-Time Risk Alerts**
  Enable live alerts when volatility crosses predefined risk thresholds.
- **Portfolio Risk Analysis**
  Extend the system to analyze multi-crypto portfolios instead of individual assets.
- **Sentiment Analysis**
  Integrate social media and news sentiment to enhance risk prediction accuracy.
- **Advanced Risk Metrics**
  Include Value at Risk (VaR), Conditional VaR, and Maximum Drawdown.
- **Automated Reporting**
  Generate downloadable PDF or Excel risk reports for investors.
- **Cloud Deployment**
  Deploy the dashboard using cloud platforms for global access and scalability.
- **User Personalization**
  Allow users to set risk preferences and customize dashboards.

THANK YOU !