**Purpose:**

=> Build a smart portfolio management system using Reinforcement Learning (RL)  
=> Include stocks as a major asset class within the multi-agent system

**About Stocks:**

A **stock** represents ownership in a company and constitutes a claim on part of the company’s assets and earnings. Investors use individual stocks to target specific industries, growth stories, or income strategies.

**Example Stocks:**

* **AAPL** – Apple Inc.
* **MSFT** – Microsoft Corporation
* **GOOGL** – Alphabet Inc.

**Market Regime Awareness via Stocks:**

Use stock performance and technical indicators to detect regimes:

| **Regime** | **Stock Signals** |
| --- | --- |
| Bull | Major indices (e.g., S&P 500, NASDAQ) ↑, VIX ↓ |
| Bear | Major indices ↓, defensive stocks ↑, VIX ↑ |
| Sideways | Low volatility, unclear directional trend |

**Types of Stock Agents:**

| **Agent Type** | **Stock Category** | **Example Tickers** | **Purpose** |
| --- | --- | --- | --- |
| Index Agent | Blue-chip indices | AAPL, MSFT, JNJ | Capture broad market trends |
| Growth Agent | High-growth tech | TSLA, NVDA, SHOP | Alpha-seeking, momentum strategy |
| Dividend Agent | Income-focused stocks | T, VZ, KO, PFE | Yield harvesting, low volatility |
| Defensive Agent | Consumer staples/utilities | PG, XEL, WMT | Market hedge, safe-haven exposure |
| Small-Cap Agent | Emerging businesses | PLTR, UPST, RIVN | High-risk/high-reward |
| Thematic Agent | ESG, AI, Fintech | AI, SQ, CRWD | Trend-following |

**Building the Multi-Agent System (Step-by-Step)**

**=> Step 1: Assign One Agent per Stock Category**

* Growth Agent follows fast-growing tech firms like TSLA or NVDA
* Dividend Agent monitors high-yield stocks like KO or PFE
* Defensive Agent watches non-cyclicals like PG or WMT

**=> Step 2: What Info Does Each Agent See?**

Each stock agent consumes:

* Historical stock prices (OHLCV)
* Technical indicators (RSI, MACD, Moving Averages)
* Volatility (Beta, ATR)
* News sentiment (from APIs like NewsAPI)
* Macro signals (Fed announcements, CPI data, etc.)

This info represents the **state** for each agent.

**=> Step 3: What Can Each Agent Do?**

Actions include:

* Allocate a % of portfolio to the stock (e.g., 30% to AAPL)
* Hold cash (risk-off mode)
* Rebalance or switch between stocks

**=> Step 4: How Do Agents Learn?**

Agents use reward signals like:

* Portfolio return – Volatility penalty
* Alpha over benchmark (e.g., SPY)
* Diversification bonus (if applicable)

**Data Sources and APIs for Stock Information**

| **API/Source** | **Purpose** | **Notes** |
| --- | --- | --- |
| **Yahoo Finance API** | Historical prices, volume, corporate data | Free via yfinance Python library |
| **Alpha Vantage** | Stock prices, fundamentals, indicators | Free tier available, requires API key |
| **IEX Cloud** | Real-time quotes, market depth | High-quality US market data |
| **Polygon.io** | Minute-level data, news | Paid tiers available for institutional-grade data |
| **Finnhub** | Financials, sentiment, earnings calendar | Good for alternative data |
| **NewsAPI** | Headlines from financial media | Combine with NLP models for sentiment signals |
| **Quandl (now Nasdaq Data Link)** | Fundamental and macroeconomic data | Used for high-level regime signals |

**Why It Matters for Our Project**

Stocks offer:

* **Granular exposure** to company-level fundamentals
* **Higher alpha potential** with careful stock picking
* **Complementarity** with ETFs, bonds, and crypto
* **Market signal generation** via broad indices or specific sector leaders