## Purpose:

=> Building a smart portfolio management system using Reinforcement Learning (RL)

## New Requirements:

=> The system should manage different types of assets like stocks, ETFs, crypto, bonds, etc.

=> Use multiple agents, each focusing on different asset types.

## About ETF:

An ETF (Exchange-Traded Fund) is like a basket of investments that you can buy or sell just like a stock. One ETF may contain many companies.

Example:

SPY = 500 big US companies (like Apple, Microsoft).

TLT = long-term government bonds.

GLD = gold.

## Market Regime Awareness via ETFs:

Use ETFs as regime proxies to classify market conditions:

| Regime | ETF Signal |
| --- | --- |
| Bull | SPY ↑, QQQ ↑, TLT ↓ |
| Bear | SPY ↓, VIX ↑, GLD ↑ |
| Sideways | Low volatility across SPY, QQQ, VIX |

## Types of ETF:

| Agent Type | ETF Category | Example Tickers | Purpose |
| --- | --- | --- | --- |
| Equity Agent | Broad Market | SPY, VTI | Stocks |
| Sector Agent | Sectoral | XLK, XLF, XLE | Technology, Finance, Energy |
| Bond Agent | Fixed Income | TLT, IEF, AGG | Interest rate exposure |
| Commodity Agent | Commodities | GLD, USO, SLV | Hedge strategies |
| Crypto Agent | Crypto ETFs | BTCC, BITO | Track Bitcoin price |
| Volatility Agent | VIX Products | VXX, UVXY | Market fear & hedging |
| Thematic Agent | Innovation | ARKK, KOMP | Trend-following strategies |

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

=> Step 1: Assign One Agent per ETF Type

Imagine you have a team of robots (agents):

One robot focuses on stock ETFs like SPY, QQQ

Another robot watches bond ETFs like TLT

Another follows crypto ETFs like BITO

Another one tracks gold or oil ETFs like GLD, USO

Each robot will learn how to invest smartly in its own type of ETFs.

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

Each agent needs to understand the market, so you’ll show it:

Past prices of its ETF

Moving averages (price trends)

Volatility (how risky it is)

News sentiment (e.g., tweets saying “market is crashing!”)

Market mood (bullish, bearish, etc.)

This collection of info is called the state of the market.

=> Step 3: What Can Each Agent Do?

Each agent can:

Decide how much money to put in its ETF (e.g., 50% in SPY, 50% in QQQ)

Do nothing if the market looks risky

These are its actions.

=> Step 4: How Do Agents Learn What’s Right?

They learn using a reward system, like how a child learns from consequences.

Example:

If the ETF goes up after an agent invests → it gets a reward

If it picks a bad time → it gets penalized

Reward = Good returns - Too much risk

## Canadian ETF Market:

| Aspect | Canadian Market Snapshot |
| --- | --- |
| First ETF | Toronto 35 Index Participation Fund (1990) |
| Toal AUM | Over $400 billion CAD as of 2024 |
| Key Providers | BlackRock (iShares), BMO, Vanguard, Horizons, CI Global |
| Exchange | Toronto Stock Exchange (TSX) |
| Growth | Rapid growth in low-cost, thematic, and crypto-linked ETFs |
| Fees | Typically lower MER (Management Expense Ratio) than mutual funds |

## Why It Matters for our Project

The Canadian market offers:

=> A wide range of ETFs across sectors and asset classes

=> Access to crypto via TSX-listed ETFs (BTCC, ETHH)

=> Liquidity and low fees – good for realistic backtesting or paper trading

=> Regime-awareness options: We can compare Canadian sectors like energy (ZEO) or banks (ZEB) to detect trends.

| ETF Ticker | Description |
| --- | --- |
| ZCN | Broad Canadian stock index (S&P/TSX) |
| XIC | iShares Canadian Composite Index |
| ZEB | Canadian Banks ETF |
| XBB | Canadian Aggregate Bond Index |
| BTCC | Bitcoin ETF (Purpose) |
| VDY | High Dividend Yield Index |
| ZCLN | BMO Clean Energy Index ETF |

## Data Sources (for training our agents)

Yahoo Finance (ZCN.TO, XIC.TO, etc.)

TMX Money (https://money.tmx.com)

ETF provider websites (BMO, iShares, etc.)

## References:

[Exchange-Traded Fund (ETF): What It Is and How to Invest](https://www.investopedia.com/terms/e/etf.asp#toc-how-etfs-work)

[ETF Facts - Canadian Securities Administrators](https://www.securities-administrators.ca/investor-tools/understanding-your-investments/etf-facts/)