FASTRADE Project Proposal

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Project Overview

FASTRADE (**FPGA-Accelerated Strategy & Trading for Enhanced Decisions)** designs and implements a system that uses Field Programmable Gate Arrays (FPGA) to calculate investment factors based on daily stock prices and generate investment strategies on these factors. The goal is to accelerate the processing of financial data to offer real-time investment insights. By leveraging FPGA for computation and software for data handling and analysis, this project aims to optimize the efficiency and accuracy of stock market investment decisions.

Background

The rapid fluctuations in the stock market require high-speed data processing to make informed investment decisions. Traditional computing methods can lag behind real-time requirements, leading to missed opportunities. By implementing critical calculations on an FPGA, we aim to significantly reduce processing times, enabling quicker decision-making. This project will demonstrate the potential of FPGA in financial analysis and its impact on investment strategies.

Hardware-Software Interface

The project will use a command-based interface for the hardware-software interaction. The FPGA will receive calculation commands from the software, process the data, and return the results for further analysis and display. This interface will allow for efficient data processing and easy integration of multiple algorithms.

User Interface

The user interface will include a VGA display to present the investment strategies and returns of different algorithms visually. A keyboard will be used to navigate between different algorithms, allowing users to compare their performance easily. This interface aims to make the system user-friendly and accessible to investors with varying levels of expertise.

Algorithms

In our quest to optimize investment strategies, we plan to incorporate three key financial factors into our algorithmic analysis: Price Momentum Factor, Volume Factor, and Volatility Factor.

- **Price Momentum Factor**: This factor assesses the stock's performance trend by comparing its current price to past prices. Stocks showing an upward trend in price are considered to

have positive momentum, indicating a potential buy signal.

- **Volume Factor**: The volume of traded shares indicates the strength behind price movements. High trading volumes in conjunction with price changes can affirm the direction of the trend, providing a more reliable signal for investment decisions.
- **Volatility Factor**: Volatility measures the rate at which a stock's price increases or decreases for a given set of returns. By analyzing volatility, investors can understand the risk associated with the stock. Lower volatility is often preferred for long-term investments.

Data Source

Our primary dataset will be sourced from Kaggle: Fintech Stock Price Data. This dataset comprises two folders: ETFS and EQUITY, containing historical data over 5 years for 10 ETFs and 22 individual stocks. Each CSV file includes daily data with eight columns: Date, Open, High, Low, Close, Volume, Dividends, and Stock Splits, totaling approximately 400 rows per stock.

Date	Open	High	Low	Close	Volume	Dividends	Stock Splits
2021-04-14 2022-10-21	46.2 381	48.4 430	40.8 346	47 357	1.57m 81.1m	0 0	0
2021-04-14 00:00:00-04:00	381.0	429.5400085449219	310.0	328.2799987792969	81065700	0	0
2021-04-15 00:00:00-04:00	348.8999938964844	349.20001220703125	317.2699890136719	322.75	39777900	0	0
2021-04-16 00:00:00-04:00	327.5	345.989990234375	321.0299987792969	342.0	22654500	0	0
2021-04-19 00:00:00-04:00	337.260009765625	341.010009765625	326.7900085449219	333.0	11405600	0	0
2021-04-20 00:00:00-04:00	333.42999267578125	334.8299865722656	312.0199890136719	320.82000732421875	18082300	0	0
2021-04-21 00:00:00-04:00	312.5199890136719	327.4700012207031	302.1000061035156	311.9200134277344	10103900	0	0

Major Tasks

1. Data Download and Pre-processing

- Clean and filter the dataset to eliminate NA values.

2. Algorithm Testing and Selection

- Evaluate various calculation algorithms for performance and accuracy.
- Implement selected algorithms in both Python and FPGA and compare results.

3. Implementation and Acceleration

- Accelerate the chosen algorithms on FPGA to generate trading strategies.
- Optimize performance based on strategy effectiveness and execution speed.

4. Simulation and Backtesting

- Simulate a real trading environment considering transaction fees and rebalancing frequencies.
- Backtest the returns using financial metrics like IC and Sharpe Ratio, comparing them against stock market indexes.

5. VGA Display of Results

- Utilize a VGA display to present investment strategies derived from different algorithms, including stock selection and expected returns.

6. Algorithm Selection via Keyboard

- Enable users to switch between algorithms using keyboard inputs to compare results.

Milestones

1. **Q1: Data Preparation**
   - ☐ Complete data download and pre-processing.
   - ☐ Establish a framework for algorithm testing.
2. **Q2: Algorithm Development and Testing**
   - ☐ Implement initial algorithms in software and FPGA.
   - ☐ Begin testing and optimization.
3. **Q3: System Integration and Simulation**
   - ☐ Integrate FPGA computations with software analysis.
   - ☐ Conduct trading simulations and backtesting.
4. **Q4: Finalization and Presentation**
   - ☐ Finalize the user interface.
   - ☐ Prepare and present the final investment strategy book.