

# ML-Driven Trading System for Sonata Software

## FYERS AQUA Challenge

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### Overview

This project implements a trend-following trading strategy with pullback-based entries. The system trades only when a clear directional bias is present and avoids chasing price by waiting for controlled corrections before entering positions.

A lightweight machine learning model is used only as a validation layer to filter out low-quality setups. The focus of the strategy is consistency, drawdown control, and realistic execution rather than aggressive profit targets.

### Core Trading Philosophy

During the study period, the stock frequently exhibited continuation behaviour: a directional move followed by a brief pause or pullback and then a resumption of the trend. Pure mean reversion performed poorly in these conditions.

As a result, the strategy trades strictly in the direction of the prevailing trend. Pullbacks are treated as entry opportunities rather than reversal signals, and counter-trend trades are deliberately avoided.

### Trend and Entry Logic

#### **Trend Identification:**

- EMA(10) and SMA(20) are used to identify directional bias
- The slope of both averages is monitored to gauge trend strength
- Market state is classified as uptrend, downtrend, or non-trending

#### **Pullback Entry:**

- Trades are considered only during established trends
- Price is required to retrace approximately 18–20% of the recent move
- The pullback must respect the moving average structure

#### **Confirmation:**

- Momentum must stabilize and begin to turn back in the trend direction
- A single confirmation bar is required to reduce noise
- The ML model acts as a final approval check

### Machine Learning Component

**Model:** XGBoost classifier with three outputs (Up / Neutral / Down).

The model is not used to forecast prices or returns. Instead, it acts as a screening tool that rejects trades where historical patterns do not support the technical setup. This keeps the strategy primarily rule-driven while allowing the model to reduce false positives.

## Risk Management

Risk control is treated as a first-class component of the system.

- Risk per trade is capped at **2%** of total capital
- Stop-loss levels are set using recent volatility (ATR-based)
- Profit targets are wider than stops to maintain favorable risk-reward
- All positions are closed by end of day

$$\text{Position Size} = \frac{0.02 \times \text{Capital}}{\text{Stop Distance}}$$

## Backtesting and Results

### Backtest Setup:

- Daily OHLCV data via FYERS API
- Walk-forward evaluation on Nov–Dec 2025
- Entry at next-day open
- SL/TP evaluated using daily high/low

### Performance Summary:

Metric	Value
Total Trades	28
Win Rate	64.29%
Total Return	2.03%
Annualized Return	4.13%
Sharpe Ratio	2.24
Maximum Drawdown	0.66%
Calmar Ratio	6.23
Final Equity	102,028

The backtest shows consistent performance with limited downside risk. While absolute returns are modest due to conservative sizing and limited trades, the strategy maintains a high win rate and very low drawdown.

## Conclusion

This strategy demonstrates that a simple trend-following approach, when combined with disciplined entries and strict risk control, can produce stable and repeatable results.

The system prioritizes trade quality over quantity and avoids unnecessary complexity. Its structure is transparent, reproducible, and suitable for real-world execution within the FYERS trading framework.