MasterPlan — Crypto Swing Analysis Suite

> *A minimal, actionable brief for engineers & downstream AIs. Keep this file up to date; delete anything that drifts into fluff.*

1. Executive Summary

Goal: Detect whether BTC/ETH swings are **sustained** (fundamental) or **transient** (noise) and size hedges automatically.

• **Core metric**: Swing Sustainability Score (0..1). ≥ 0.7 → heavy hedge. ≤ 0.3 → light hedge.
• **Edge**: Fuse sentiment, order-book liquidity, and on-chain flows under 5 s.

2. Evidence Snapshot (peer-reviewed, verified)

Finding	Source	Why it matters
Neutral & negative Twitter sentiment moves intraday liquidity and volatility in BTC/ETH/LTC/XRP	MDPI Data **10(4):50** (2025)	Sentiment links directly to micro-moves our desk cares about
Sentiment-enriched LSTM beats price-only models (MAE ↓18%)	BDCC **7(3):137** (2023)	Adding NLP signal improves short-horizon prediction
FinBERT + GPT-4 ensembles hit 86 % directional accuracy with careful tuning	BDCC **8(6):63** (2024)	Sets realistic ceiling; tuning cost visible
Twitter bot manipulation inflates positive sentiment & volume	Finance Research Letters **61** (2022)	Must de-bot feeds before scoring
Sentiment often lags price in crypto hype cycles	IJFS **13(2):87** (2025)	Need lag/reversal features

Finding	Source	Why it matters
Influencer tweets cause ~60 min spikes then mean-revert	Technol. Forecast. Soc. Change **186** (2023)	Down-weight celebrity bursts

3. Key Insights (TL;DR)

1. **Sentiment is tradable but weak** (~55-60 % accuracy standalone). Edge comes when fused with order-book + on-chain data.
2. **Noise is structural** — bots, shill threads, influencer pumps distort raw feeds → clean before use.
3. **Lag cuts both ways** — positive sentiment lags big up-moves; neutral/negative affects liquidity contemporaneously.
4. **Complexity tops out fast** — FinBERT/GPT-4 ≈ 86 % hit-rate ⇒ diminishing returns beyond ensembles.
5. **Liquidity is king** — sentiment's PnL value comes via depth/spread, not direction.
6. **Human override still needed** — retain sign-off for Score <0.1 or >0.9 (manipulation risk).

4. Gap Analysis — Alignment vs Expert Wisdom

Component	Expert View	Action
Sentiment scraper → ML classifier	Supported (Data 2025, BDCC 2023)	Add bot filter & influencer down-weight
Score thresholds 0.7 / 0.3	No academic consensus	Walk-forward optimise on 2021-24 data
Liquidity feature integration	Strong evidence	Include depth/spread delta
5 s latency budget	Uncontested	Async I/O + cache
Fully automated hedging	Experts flag manipulation	Keep human check on extremes

5. High-Level Approach (no timeline)

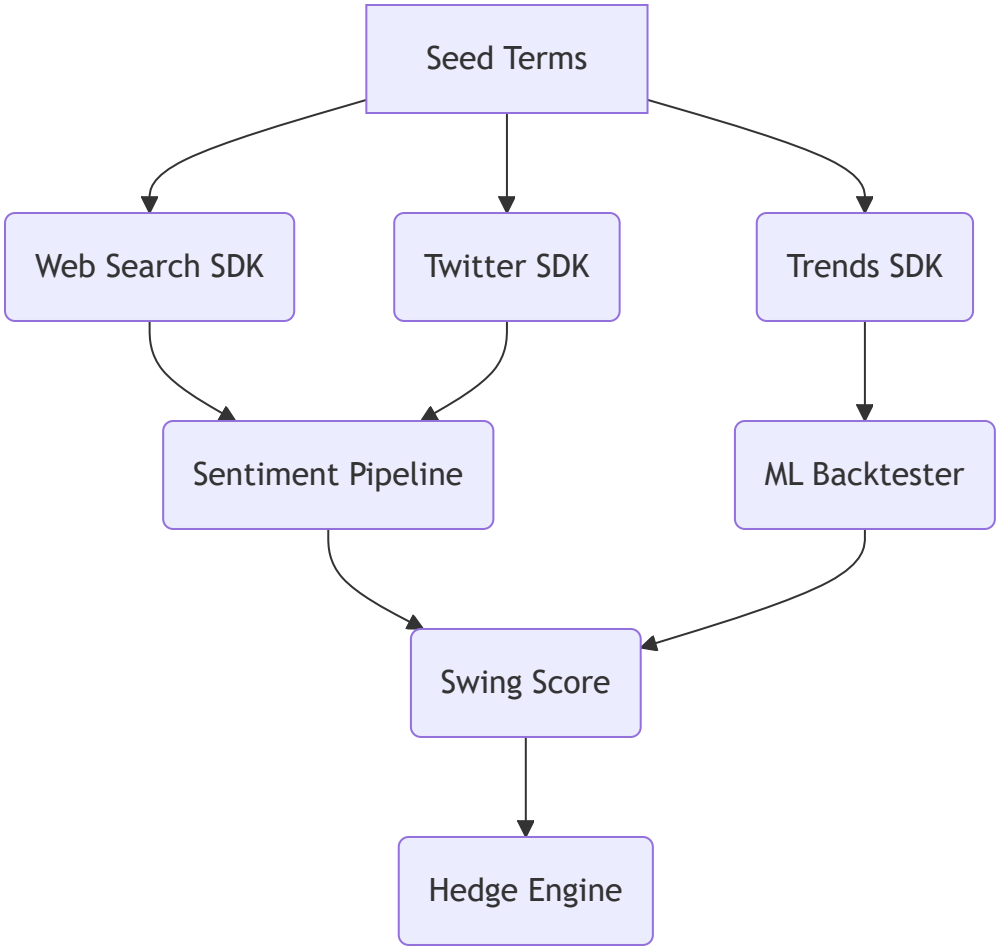
1. **Data Ingestion** — Async pull: tweets (Botometer-flagged), news, on-chain, order-book snapshots.
2. **Feature Layer** — De-bot, detect sarcasm, compute lag windows & liquidity deltas.
3. **Model Ensemble** — XGBoost (tabular) + FinBERT (text) + rule-based lag trigger.
4. **Score → Hedge** — Map score to hedge size; manual override if manipulation risk.
5. **Continuous Eval** — Walk-forward validation, Sharpe/drawdown monitor, alert on drift.

6. Repo Map & Architecture

Repositories

Repo	Purpose	Key Tech
`web-search-sdk`	Async Google/news scraping, full-article parsing	httpx, BS4, Playwright
`twitter-sdk`	High-throughput Twitter ingest & virality detection	Tweepy, proxy rotation
`sentiment-pipeline`	NLP (FinBERT, GPT-4) + feature engineering	Transformers, LangChain
`ml-backtester`	Model training & historical replay	XGBoost, PyTorch, Backtrader
`trends-sdk`	Google Trends high-volume client	Custom async client

System Diagram



7. Appendix — Backtesting & Validation (one-pager)

- **Data**: 2017-24 tweets, order-books, on-chain.
- **Primary test**: Enter swing if ΔSentiment ≥ +10 % vs 24 h mean; exit when score <0.5.
- **Metrics**: Sharpe, max drawdown, hit-rate, liquidity impact.
- **Noise Stress**: Inject bot noise per FRL 2022; rerun 1k Monte Carlo paths.
- **Crisis Replay**: May-21 crash, Nov-22 FTX, 2024 ETF rally.

Open Questions

- False-hedge cost vs missed-hedge cost?
- Minimum liquidity threshold to act?

• Regulatory constraints on scraping volume?
• Integration point with existing risk dashboard?

> **Evidence drives design; expand scope only if new data proves edge.**