Automated Bitcoin Trading – Feinkonzept

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Contents

1 Problem Statement

The Bitcoin market is liquid but still exhibits short-term inefficiencies caused by leverage, liquidations and order-flow imbalances. The aim of this thesis is to **develop, validate and live-test a realistic algorithmic strategy** that can exploit such any kind of market inefficiencies within the available project timeline.

2 Research Objectives

1. Identify statistically significant signals that signal potential short-term price moves.
2. Convert the most promising signal(s) into an executable rule-based strategy.
3. Evaluate performance via back-testing and a four-week live test (16 Jun – 14 Jul 2025).
4. Document robustness, limitations and possible improvements.

3 Data & Tools

Depth-weighted order-book snapshots at a **1-minute resolution** and corresponding trade prints are collected via the Hyperliquid API (March – May 2025). All analysis is performed in Python using *pandas* for data handling, *vectorbt* for parameter sweeps and back-testing, and *Plotly* for interactive visualisation.

4 Methodology

4.1 Exploratory Data Analysis

Initial work will focus on descriptive statistics of depth-weighted bid/ask deltas, volatility clustering and liquidation events. Rolling correlations and lead–lag plots help decide which variables are worth modelling.

4.2 Signal Development

Several candidate signals will be tested, e.g.

- Order-flow-imbalance (OFI) quantiles
- Depth-specific delta momentum
- Combined price–volume features

Each candidate is evaluated with walk-forward back-tests to avoid look-ahead bias.

4.3 Risk & Position Sizing

Stop-loss / take-profit distances will be tuned via grid-search. Maximum capital at risk per trade is capped at 1 % of account equity.

4.4 Live Deployment

The best performing rule set will be deployed with real capital ($500) for four weeks. All trades, latency metrics and PnL are logged automatically.

5 Project Timeline

Phase	**Weeks / Dates**
Exploratory analysis & signal ideation	KW 17 – KW 21 (24 Apr – 26 May)
Parameter tuning & dry-run (paper trading)	KW 22 (27 May – 2 Jun)
Live deployment (real funds)	KW 25 – KW 28 (16 Jun – 14 Jul)
Result analysis & thesis writing	KW 29 – KW 33 (15 Jul – 18 Aug)
Editing, final layout, submission	KW 34 – KW 36 (19 Aug – 5 Sep)

6 Expected Deliverables

- Clean, annotated Python code for data handling, back-testing and live execution.
- A statistical report comparing candidate signals.
- Final thesis (30 pages) detailing methodology, live results and critical reflection.

7 Risk Management

- **Market risk:** fixed stop-loss and kill-switch at –3 % account equity.
- **Over-fitting:** walk-forward validation and out-of-sample hold-out.
- **Operational risk:** cloud server with automatic restart and daily data backup.