



THE DESIGN OF AN AUTOMATED TRADING SYSTEM FOR VIRTUAL CURRENCIES

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Abstract: This article explores the integration of modern technologies, particularly into Automated Trading Systems for cryptocurrency markets. By leveraging algorithmic trading, ATS eliminates emotional biases, ensures rapid trade execution, and allows for simultaneous monitoring of multiple indicators. The study delves into the foundational concepts of algorithmic trading, including technical analysis, trading strategies, and the unique characteristics of cryptocurrencies, with blockchain technology as their backbone.

Keywords: Automated Trading Systems (ATS), Cryptocurrencies, Blockchain, Technical Analysis (TA), Artificial Intelligence (AI)

Introduction

Generating passive income is a common practice today. Investing in various assets is an appealing way to grow one's financial wealth. With the right choice of assets and a well-structured strategy, it is possible to achieve significant returns. Automation and the use of modern machine learning technology can enhance these processes, leading to even better outcomes.

Automated Trading Systems

Automated trading, also known as algorithmic trading, is the use of computer programs to execute trading orders on an exchange without the need for direct human intervention. It is a system that makes decisions in real time based on predefined rules and belongs to the field of enterprise information systems (EIS). Thanks to significant advances in computing and telecommunication technologies, the variety and complexity of these systems is constantly increasing. Research teams and business professionals alike are devoting considerable effort to identifying factors that could lead to higher profits.[1]

The essence of an automated trading system lies in the ability to set fixed rules for entering and exiting a trade, which are then executed automatically. These rules can be based on various technical indicators, price levels or volume signals. It is currently estimated that up to three quarters of all trades in the US equity markets are executed by such automated system, highlighting their dominant role in contemporary financial markets.[2]

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Technical Analysis (TA)

Technical analysis is an analytical approach that focuses on examining the historical development of prices and trading volumes in order to estimate the future movements of financial assets such as stocks, currencies or cryptocurrencies. Unlike fundamental analysis, which examines the intrinsic value of an asset, technical analysts work with charts and look for repeating patterns, trends or breakout price levels as support and resistance.[10] The goal of technical analysis is to support trader's decision-making by providing a framework to identify potential market entries and exits. This approach often reflects the psychology of the market and is particularly effective when combined with other analytical methods.[5] Despite its widespread use, technical analysis is a subject of debate. From the perspective of a strong form of the efficient market hypothesis (EMH), technical analysis is considered inefficient because all information should already be included in asset prices.[4] At the same time, however, it turns out that in a real market environment, prices are often influenced by the collective behaviour of market participants. The result is a phenomenon known as herding behaviour, where traders blindly follow the same signals from technical indicators.[6] It is this synchronisation of decisions that can lead to significant volatility and market instability. In such cases, technical analysis can come to fruition as a self-fulfilling prophecy, as trader's behavior causes the price movement that technical analysis predicted.[7,8,9]

Technical analysis is implemented in practice through regularly applied indicators that transform historical market data into trading signals. The most widely used tools include the simple moving average (SMA) and the relative strength index (RSI).[10]

Simple Moving Average (SMA)

SMA is a basic indicator that calculates the average price of an asset over a selected time period. It is used to smooth out price fluctuations and reveal long-term trends. Usually, closing prices from OHLC data are used:[10]

$$SMA_n(t) = \frac{\sum_{i=t-n+1}^t p_i}{n} = \frac{(p_t + p_{t-1} + \dots + p_{t-n+1})}{n}$$

where p_t represents the closing price at a given time t and n denotes the number of periods included in the average.

Relative Strength Index (RSI)

RSI is one of the oscillators that measure the rate and magnitude of price changes. This indicator helps to identify whether an asset is currently oversold or overbought, with its value ranging between 0 and 100:[10]

$$U_{(t)} = \begin{cases} p_t - p_{t-1}, & \text{if } p_t > p_{t-1} \\ 0, & \text{otherwise} \end{cases}$$

$$D_{(t)} = \begin{cases} p_t - p_{t-1}, & \text{if } p_t < p_{t-1} \\ 0, & \text{otherwise} \end{cases}$$

where $U(t)$ and $D(t)$ are the conditional return measures for each time step t . To calculate the RSI, the RS measure is first calculated:

$$RS_n(t) = \frac{\sum_{i=t-n+1}^t U_{(i)}}{\sum_{i=t-n+1}^t D_{(i)}}$$

RSI is particularly popular because it offers an intuitive view of the strength of the current trend and can signal a possible reversal.

$$RSI_n(t) = 100 - \frac{100}{1 + RS_n(t)}$$

Cryptocurrencies

A cryptocurrency system is a digital infrastructure designed to issue so-called tokens that serve as general or specific means of payment in the digital space. These tokens do not need to be backed by any central authority - instead, their transactions are recorded in a decentralised digital accounting system, which is often managed collectively by a community of network participants. The basis of trust in these systems is not traditional institutional collateral, but the use of advanced cryptographic mechanisms. These ensure the authenticity, transparency and immutability of data without the need for an intermediary. In this context, the term “cryptocurrency” refers to a digital token issued within such a system, the purpose of which is to serve as a store of value or a medium of exchange - whether universal or limited to a specific use.[11]

Blockchain

Blockchain technology is an open and global digital infrastructure that enables direct interaction between entities without the need for an intermediary. This significantly reduces both transaction costs and processing time. The system operates on the principle of a decentralised database and decision-making by consensus. Transaction records are stored in a digital ledger that is shared between computers „nodes“ in the network. This ledger is not owned by any central entity and is accessible to all participants in the network. If a user wants to write a new transaction, its data is encrypted and then verified by other nodes through cryptographic algorithms. If the majority of nodes validate the transaction, a new block is created and added to the chain. This process makes the records immutable, transparent and auditable. Blockchain also eliminates the need for duplicates in documents, third-party intervention and subsequent correction processes.[12]

Each block contains a specific identifier called a hash, which is used to verify the block's contents. Every subsequent block added to the chain validates the previous block and carries information about its contents. This interconnection ensures that any alteration to a block would require changes to the entire chain. Figure 1 illustrates the structure of blockchain blocks, starting with the original block, known as the genesis block.[13]



Figure 1. Blockchain Structure Source:[13]

As shown in Figure 1, each subsequent block in the chain contains the hash of the preceding block, which ensures its validity.

Proposal of an ATS model

The ATS structure, depicted in Figure 2, comprises essential components such as a Python-based application with coded trading strategies, hosted on a virtual server for continuous online availability. The system integrates with trading exchanges via API keys and connects to the Tradingview platform to receive buy/sell signals.[13]

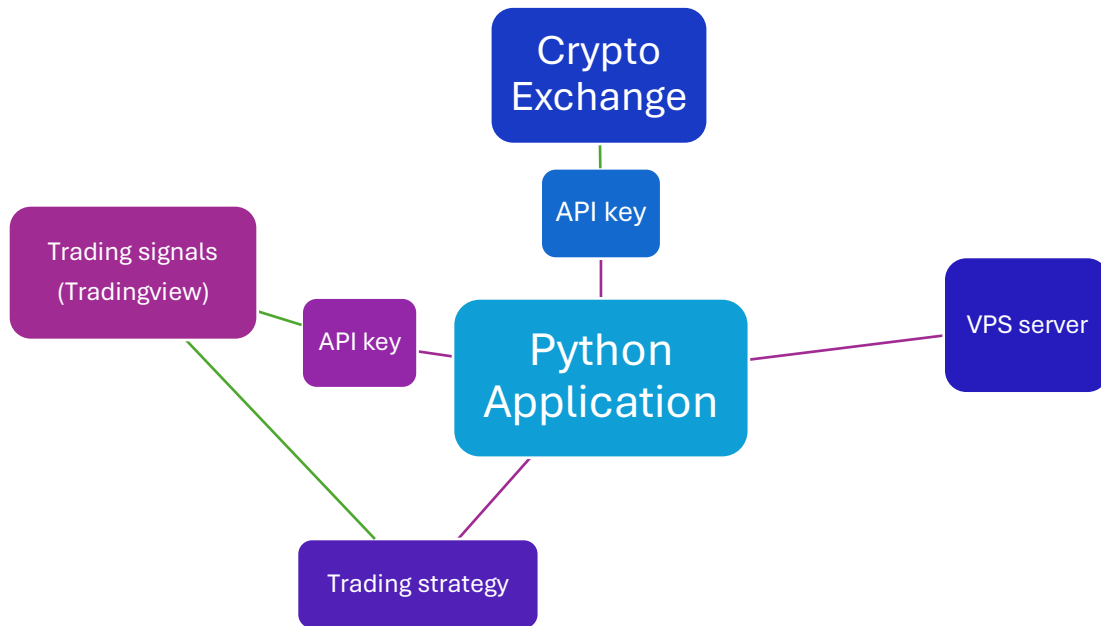


Figure 2. Proposal of an ATS model Source:[13]

Steps to Develop an ATS:

1. **ATS Application:** Choose a programming environment. Python, with its simple syntax, extensive libraries, and suitability for AI models like machine learning, is a good choice.
2. **Trading Strategy:** Code a strategy dictating the system's trading actions.
3. **TradingView Account:** This platform offers market analysis tools, real-time data, and a repository of community-generated strategies.
4. **Strategy Upload to TradingView:** Implement custom strategies using Pine Script or adapt existing ones from the community repository.
5. **Cryptocurrency Exchange Account:** Consider factors like liquidity, security, and user-friendliness when selecting an exchange.
6. **API Integration:** Link the ATS to exchanges and TradingView using API keys for data communication and trade execution.
7. **Hosting on Virtual Server:** Deploy the ATS on a cloud-based virtual server for uninterrupted operation.

By leveraging these steps, the ATS can achieve robust functionality, enabling seamless integration of AI-driven strategies into automated trading systems.[13]

Conclusion

Automated Trading Systems, powered by advanced technologies like Artificial Intelligence, offer a transformative approach to cryptocurrency trading. By automating decision-making processes, these systems enhance efficiency, reduce emotional biases, and provide traders with tools to navigate complex financial landscapes. This article has highlighted the theoretical foundations of algorithmic trading, technical analysis, and the pivotal role of blockchain technology in securing cryptocurrency transactions.

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