QuantSys: A Stock Breakout Value Prediction System using an Algorithmic Approach

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ABSTRACT
In today's fast-moving financial markets, traders—whether beginners or seasoned professionals—need tools that can simplify decision-making and help them stay ahead of market trends. This paper presents *QuantSys*, a smart and user-friendly stock market prediction system designed to support better and faster trading decisions using well-established technical indicators. Instead of relying on complex and hard-to-understand models, *QuantSys* focuses on trusted, time-tested tools like Simple Moving Averages (SMA) and Exponential Moving Averages (EMA) to analyze stock price behavior. These indicators are widely used in the trading community for spotting trends, identifying momentum, and predicting possible breakout or reversal points. *QuantSys* is built using Python and leverages the *yfinance* module to collect real-time stock data directly from the financial markets. This data is analyzed automatically, and the system continuously monitors stock movement across various timeframes, such as 1-minute, 5-minute, daily, and weekly intervals. The use of different timeframes allows the system to cater to various types of traders—from intraday scalpers to long-term investors—by giving context-aware signals suited to different strategies. One of the standout features of *QuantSys* is its seamless integration with a Telegram bot, which acts as a real-time communication channel between the system and the user. As soon as a potential trading opportunity is identified—such as a price crossover the moving average—the system sends a detailed and instant alert to the user's Telegram account. This ensures that the trader can react quickly without having to sit in front of charts all day. The goal of *QuantSys* is to reduce the effort required in technical analysis, improve response time, and make reliable predictions accessible to all types of users. By automating the collection, analysis, and alert delivery processes, the system saves time and reduces the chance of missed opportunities. Overall, *QuantSys* offers a practical and efficient solution for anyone looking to trade smarter, faster, and with more confidence in today's volatile market conditions.

General Terms
Algorithmic Trading, Real-Time Systems , Automation, Financial Data Analysis, Stock Market Prediction, Technical Analysis, Artificial Intelligence, Signal Processing, Decision Support Systems.

Keywords
Stock Prediction, Exponential Moving Average (EMA), Simple Moving Average (SMA), Breakout Detection, *yfinance* (yahoo finance), Trade Alerts, Trend Analysis, Real-Time Data, Intraday Trading, Moving Average Crossover, Automated Trading System.

1. INTRODUCTION
The way people trade in the stock market has changed significantly with the rise of algorithmic trading [1]. In the past, traders had to spend many hours analyzing stock charts, identifying trends, and creating strategies—all of which required experience and close attention. This manual process was not only time-consuming but also left room for human error. To solve this problem, *QuantSys* was developed, a smart and automated prediction system that uses real-time data to help traders make better decisions with less effort.

QuantSys is designed for both beginners and experienced traders. Its main goal is to assist users in making informed decisions when buying or selling stocks. It does this by using technical indicators and statistical models that are widely used and trusted in the trading world [2], [3]. Today's financial markets generate huge amounts of data every second. Traders need tools that can quickly analyze this data, identify useful patterns, and send out timely trade suggestions. *QuantSys* does exactly that by combining timeline-based algorithms with tools like moving averages to deliver reliable insights for both short-term trading and long-term investing [4], [5], [6].

Stock trading is complex because prices are always changing due to many different factors, such as economic reports, company performance, global news, and investor behavior. Relying on guesswork is not enough—traders need systems that can analyze market data in real-time and adapt to these changes quickly [7], [8]. However, monitoring charts and trends manually across different timeframes can be tiring and inefficient.

This is why automated trading systems have become increasingly popular. *QuantSys* was created to meet this need by offering a user-friendly platform that automates the analysis of stock trends while providing accurate and timely insights. It uses a mix of historical market data and real-time inputs, along with proven technical indicators, to improve the accuracy of its predictions.

One of the standout features of *QuantSys* is its integration with the *yfinance* module, which allows it to pull the most recent stock market data directly. This ensures that all predictions and trade signals are based on the latest market activity, allowing users to respond quickly to changes. Additionally, *QuantSys* includes a Telegram bot that sends instant alerts to users whenever it detects a trade opportunity. This ensures that users can take action right away, even if they are not actively watching the market.

In today's fast-moving financial world, traders often struggle to keep up with the overwhelming amount of data available to

them. *QuantSys* helps solve this problem by analyzing the market automatically, detecting important price changes, and sending out clear and timely trade suggestions. As a result, traders can act faster and more confidently. Whether someone is new to the stock market or an experienced investor looking to refine their strategies, *QuantSys* provides a helpful tool to reduce guesswork and improve decision-making in a fast-paced market environment.

2. LITERATURE REVIEW

In recent years, algorithmic trading has emerged as a dominant trend in financial markets, enabling the automation of trading decisions based on predefined rules and real-time data. Algorithmic trading systems help reduce latency and human error while increasing trading efficiency [9]. These systems rely on historical data and real-time information to make accurate decisions at high speed, which is critical in today's volatile market conditions.

Technical indicators such as Moving Averages (Simple and Exponential), are commonly used in algorithmic systems to identify market trends and potential entry/exit points. [10], [11] demonstrated the effectiveness of combining these indicators in predicting breakout zones and reversals in stock price movements. *QuantSys* builds on these findings by applying multiple indicators in tandem to generate more reliable trading signals [12], [13].

The use of APIs like *yfinance* to access real-time financial data has also gained popularity. Tools such as Yahoo Finance allow systems to fetch minute-by-minute price updates, which are essential for intraday strategies. Real-time data fetching reduces the latency in decision-making, as supported by research from [1], [9] who emphasized the importance of live data for time-sensitive trading strategies.

Additionally, the use of communication platforms like Telegram bots for alerting users has become a practical solution for real-time notifications. *QuantSys* explored bot-based notification systems in financial applications, finding that immediate alerts increase user engagement and decision speed. *QuantSys* leverages this by integrating a Telegram bot that informs users of trade signals as they happen, reducing the need for constant manual monitoring.

Overall, the existing literature supports the design philosophy of *QuantSys*: combining traditional technical indicators with real-time data analysis and seamless user notifications to create a practical and user-friendly trading assistant. The system aligns with contemporary research trends and addresses gaps in user customization, automation, and accessibility in stock prediction systems [14], [15].

3. PROPOSED SYSTEM

QuantSys utilizes a combination of the following components to ensure accurate stock predictions.

3.1 Data Collection

To power the trading signal system, live stock market data is gathered using the *yfinance* Python library. This tool helps pull up-to-date information about stock prices, including the opening price, highest and lowest prices during a time period, and the closing price (OHLC data).

For intraday trading, data is collected at short intervals, such as every 1 or 5 minutes. For daily and weekly trading, data is gathered on a daily and weekly basis, respectively. Among these values, the focus is primarily on the closing prices because they play a key role in calculating two popular technical indicators: Simple Moving Average (SMA) and Exponential Moving Average (EMA). These indicators helps to identify potential buy or sell opportunities based on price trends.

Once the data is collected, it is passed on to a Node.js backend, where all the analysis and decision-making happens. Based on this, the system generates signals and sends them directly to users through a Telegram bot, allowing them to act quickly based on real-time insights.

This live data collection and processing setup helps the system stay updated with current market movements and provides timely trading suggestions to users.

3.2 Data Processing in *QuantSys*

3.2.1 Fetching Real-Time Market Data

QuantSys retrieves live stock data using the *yfinance* Python module. The system collects key attributes like OPEN, CLOSE, HIGH, LOW, and VOLUME values at different time intervals (e.g., 5-minute, 15-minute, daily).

3.2.2 Data Processing & Structuring

The raw data is structured into arrays for each price attribute (OPEN, CLOSE, HIGH, LOW).

CLOSE prices are specifically used for computing key technical indicators like EMA and SMA.

3.2.3 Calculating Technical Indicator

Simple Moving Average (SMA): Calculated using a rolling window of past closing prices to identify trends.

Exponential Moving Average (EMA): Gives more weight to recent prices, allowing quicker trend detection.

3.2.4 Identifying Trade Signals

The system analyzes indicator crossovers using variable lengths of Moving Averages (e.g., EMA-5 crossing above SMA-15 or EMA-2 crossing above EMA-10 depending on the short or long-term trading requirements) to detect bullish/bearish trends.

3.2.5 Generating Trade Predictions

QuantSys , based on processed indicators, determines potential entry and exit points.

The system sends real-time trade signals via the integrated Telegram bot to notify traders instantly.

3.3 Technical Indicators

QuantSys implements key technical indicators to predict stock price movements :

3.3.1 Exponential Moving Average (EMA)

The Exponential Moving Average (EMA) is a type of weighted moving average that gives more weight to recent price data, making it more responsive to current price movements. This characteristic makes it especially useful for short-term traders looking for timely signals.

Mathematical Formula:

$$\boldsymbol{EMA_t = \alpha \cdot P_t + (1 - \alpha) \cdot EMA_{t-1}} \quad \textbf{(1)}$$

Where:

EMA_t = EMA at time *t*

P_t = Price at time t

EMA_{t-1} = EMA at time $t - 1$

α = Smoothing factor

Smoothing factor (α):

$$\alpha = \frac{2}{n+1}$$

Where

n = Number of periods

Use Cases :

Short-Term Trading – EMAs are commonly used in intraday trading and swing trading because of their quick responsiveness to price fluctuations.

Identifying Trends – Traders use EMAs to confirm the direction of a trend. An upward-sloping EMA typically signals that the market is in an uptrend, whereas a downward-sloping EMA often points to a declining or bearish trend.

Crossover Strategy – EMAs are often used in pairs (e.g., EMA(9) and EMA(21)) to generate buy/sell signals when the shorter EMA crosses above or below the longer EMA.

Momentum Trading – The EMA helps traders spot strong momentum, making it useful for breakout strategies.

Pros of EMA :
Fast Response to Price Changes – More useful for short-term traders who need real-time trend confirmation.

Better for Trend Reversals – Helps traders quickly identify reversals compared to the SMA.

Popular Among Day Traders – Used in fast-paced markets like forex and cryptocurrency.

Cons of EMA :
More Prone to False Signals – Because of its sensitivity, EMA can sometimes generate too many trade signals, leading to whipsaws.

Less Effective for Long-Term Analysis – Since it reacts more to recent data, long-term investors may find it less stable.

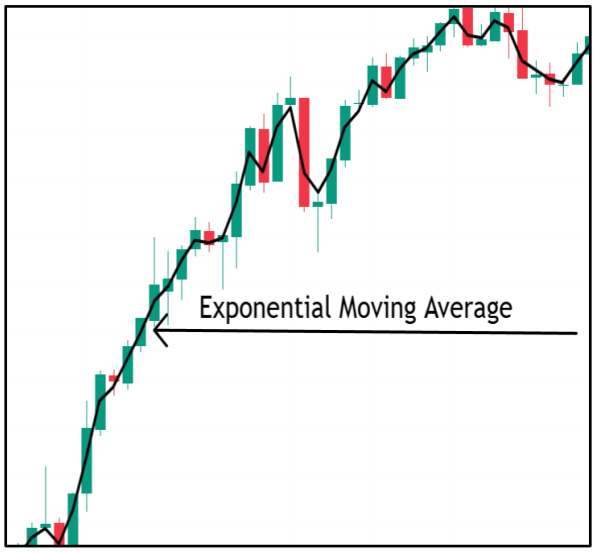

Fig 1: Exponential Moving Average (EMA) Curve Demonstrating Real-Time Price Sensitivity in Stock Market Trends

3.3.2 Simple Moving Average (SMA)

The Simple Moving Average (SMA) is the most basic form of moving average, calculating the average price over a fixed number of periods. Unlike EMA, all price points have equal weight in the calculation.

Mathematical Formula:

$$SMA_t = \frac{P_t + P_{t-1} + \cdots + P_{t-n+1}}{n} \quad (2)$$

Where:

SMA_t = Simple Moving Average at time t

P_t = Price at time t

n = Number of periods

Use Cases :
Long-Term Trend Analysis – SMAs are commonly used by investors for long-term trend identification (e.g., SMA(50), SMA(200)).

Support and Resistance Levels – Many traders use SMA lines as dynamic support or resistance levels.

Golden Cross & Death Cross –

- Golden Cross: When EMA (50) crosses above SMA (200), signaling a bullish trend.
- Death Cross: When EMA (50) crosses below SMA (200), signaling a bearish trend.

Reducing Market Noise – Since SMA smooths out fluctuations, it's useful for investors focusing on macro trends.

Pros of SMA :
Stable and Reliable for Long-Term Investors – Less sensitive to price fluctuations, making it ideal for trend-following strategies.

Reduces Market Noise – Filters out short-term volatility to provide a clear picture of trends.

Cons of SMA :
Slower to React to Price Changes – Not ideal for traders who need quick entry and exit signals.

May Lag in Identifying Trend Reversals – Since it relies on historical data, it can sometimes signal a trend too late.

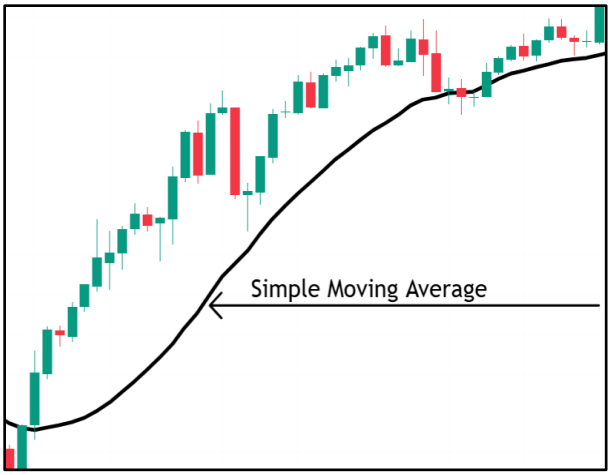

Fig 2: Simple Moving Average (SMA) Visualization for Long-Term Trend Identification

3.4 Moving Average Methods in Stock Price Prediction

Moving averages are one of the most widely used techniques in technical analysis for predicting stock price movements. They help traders identify trends, smooth out price fluctuations, and generate trading signals. Below are two key methods that utilize moving averages for stock price prediction.

How It Works

Trend Identification: The moving average smooths out price fluctuations, making it easier to identify upward, downward, or sideways trends.

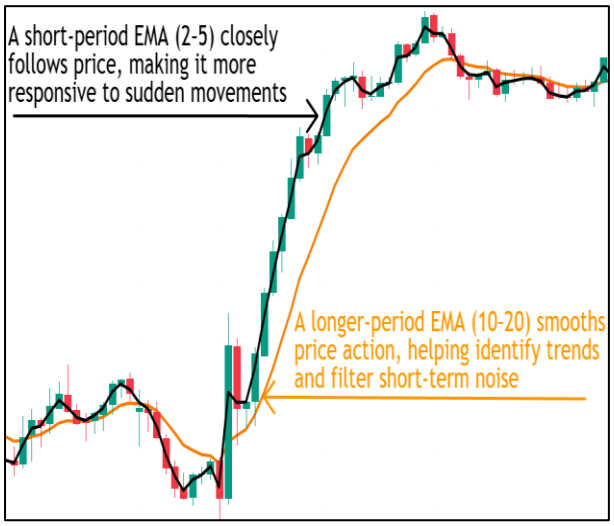

Fig 3: Comparison of Short-Term vs Long-Term EMAs for Trend Strength and Momentum Detection

Moving Average Crossover Strategy:

When a short-term moving average (e.g., EMA-5) crosses above a long-term moving average (e.g., SMA-20) it generates a bullish signal (Golden Cross).

If a short-term moving average falls below a longer-term one, traders often see it as a warning that the market could be turning bearish (Death Cross).

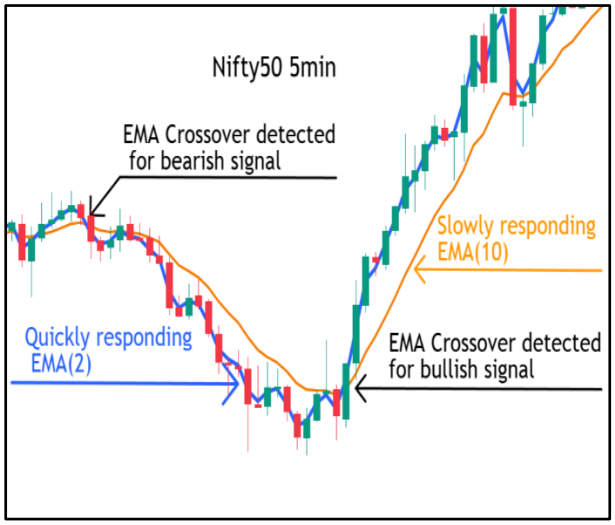

Fig 4: EMA(2) and EMA(10) Crossover Strategy Indicating Bullish and Bearish Market Signals

Support and Resistance Levels:

Moving averages act as dynamic support in an uptrend and dynamic resistance in a downtrend.

Use Cases

Long-Term Investing: Investors use SMA(200) and SMA(100) to track macro trends and make investment decisions.

Short-Term Trading: Traders use EMA(9) and EMA(21) for momentum-based trades and quick trend reversals.

Intraday Trading: Traders use EMA(2) and EMA(15) for momentum-based trades and quick trend reversals.

Market Trend Confirmation: The direction of the moving average confirms whether a stock is in a bullish, bearish, or consolidating phase.

Advantages

Removes Short-Term Noise: Smooths out random price fluctuations, making it easier to analyze trends.

Simple to Implement: A basic yet powerful method that works across different time frames.

Versatile Strategy: Can be used in stocks, forex, commodities, and cryptocurrencies.

Limitations

Lagging Indicator: Since it relies on past data, it does not predict sudden price movements caused by unexpected events.

False Signals: Crossover strategies can sometimes generate misleading signals in sideways markets.

3.5 Trading Strategy

The core trading strategy used in *QuantSys* revolves around a combination of well-established technical indicators and price action patterns that are easy to understand but highly effective in real-world trading. At the heart of the system are Simple Moving Averages (SMA) and Exponential Moving Averages (EMA), which help in identifying market trends and potential reversal points. These indicators are widely trusted in the trading community for their ability to cut through the noise and highlight meaningful movements.

QuantSys tracks moving average crossovers, such as a short-term EMA crossing above or below a long-term SMA, to signal potential bullish or bearish trends. These crossovers serve as early warnings for possible price shifts, helping traders stay one step ahead of the market. What makes *QuantSys* more versatile is that it doesn't just apply this logic to one timeframe—it analyzes data across multiple intervals, like 1-minute and 5-minute charts for intraday trading and daily or weekly charts for longer-term strategies. This makes it suitable for different types of traders, from scalpers to swing traders.

Another key element of the strategy is the timeline-based breakout detection. The system looks for candles that are completely below key moving averages, signalling that the price might be undervalued or preparing for a breakout. If the next candle breaks above the previous high, *QuantSys* marks it as a bullish entry opportunity. This method gives a more dynamic edge to the strategy, ensuring that trades are based on real momentum rather than assumptions.

The platform also takes care of entry and stop-loss levels automatically, making it easier for traders to manage risk without second-guessing. For example, the breakout candle's High is used as the entry point, while the low acts as a logical stop-loss level, helping to minimize losses during false breakouts.

By combining these techniques, *QuantSys* delivers a strategy that is not only technically sound but also practical for everyday use. It helps reduce emotional decision-making and brings more structure to trading. The goal is to give users the confidence to make smarter trades—whether they're just starting out or already experienced in the markets.

3.6 Notification System

3.6.1 Integration with Telegram Bot:

QuantSys is integrated with a Telegram bot that delivers real-time trading signals and alerts directly to users. This integration ensures traders can respond to market movements quickly.

3.6.2 Real-Time , High Reliability, and Speed:

QuantSys delivers real-time trading alerts via a Telegram bot, ensuring timely and reliable updates.This allows traders to act swiftly in dynamic market conditions without constant manual monitoring. Timely alerts help traders stay informed without the need to constantly monitor the markets themselves.

3.6.3 Tailored to Trading Strategies:

The notification system can be aligned with specific trading strategies, whether users are risk-averse or prefer aggressive trading. Traders can filter alerts based on personal investment goals, allowing for better control over decision-making.

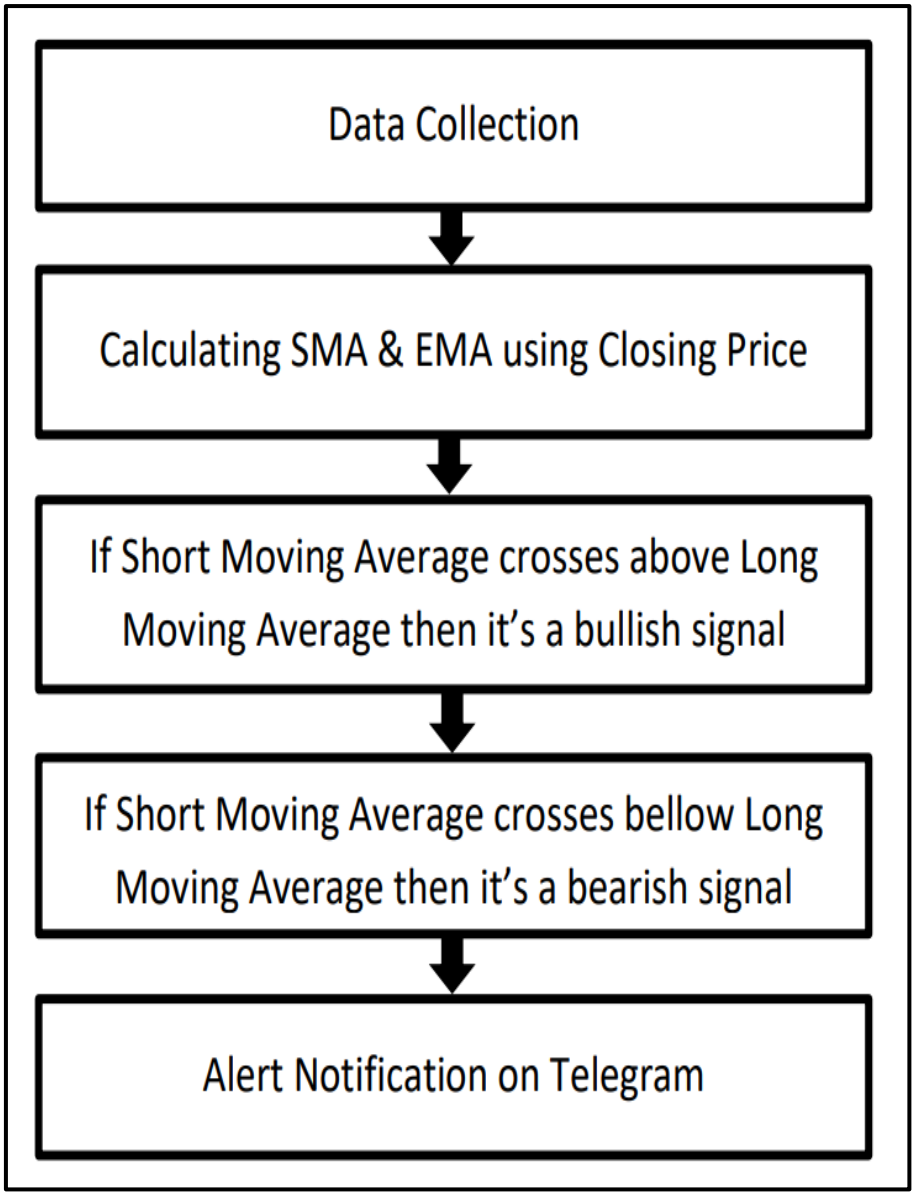

Fig 5: Workflow Diagram of the QuantSys Trading Signal Generation and Alert Delivery System

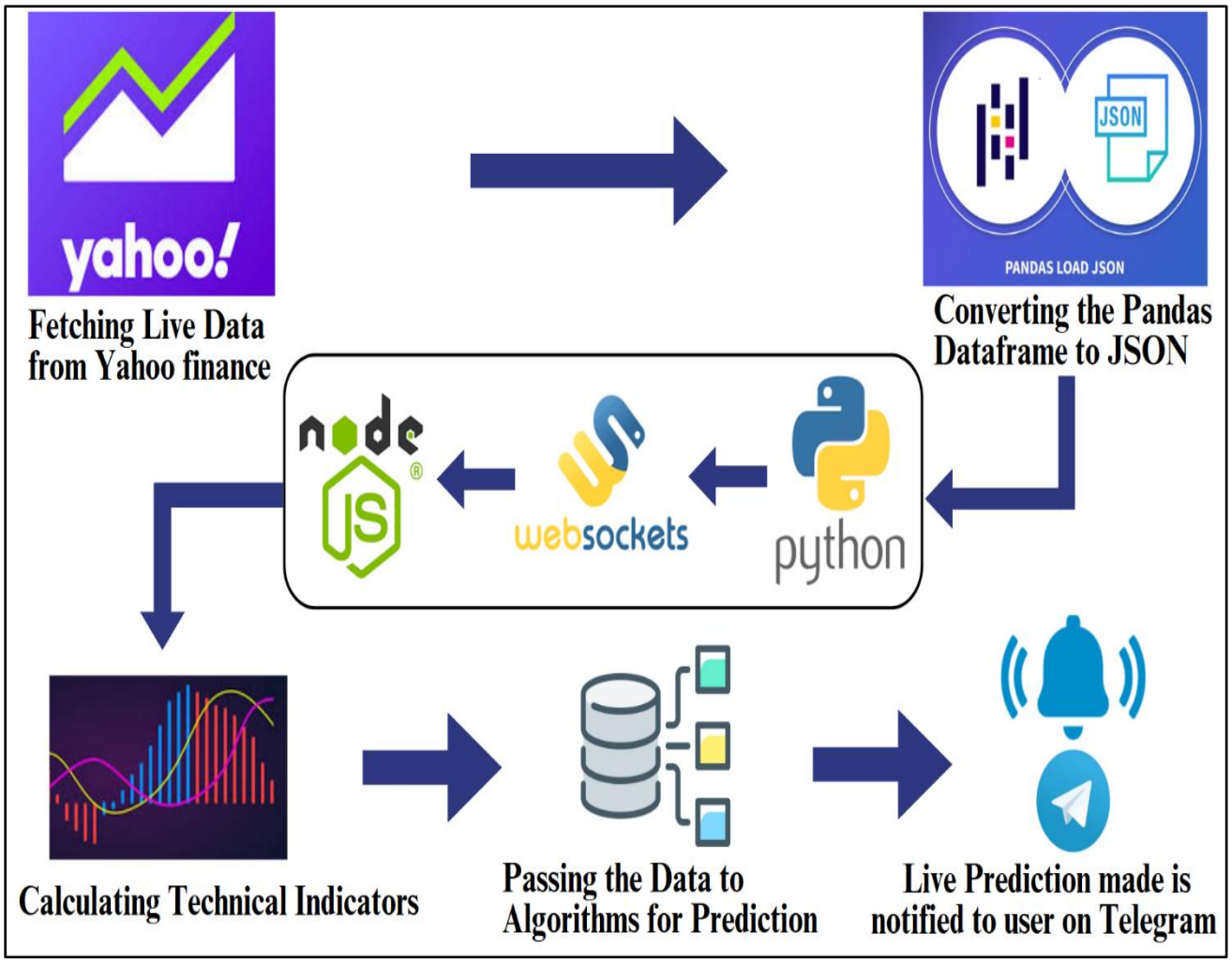

Fig 6: System Architecture of QuantSys with Real-Time Data Flow and Telegram Integration

4. RESULT And ANALYSIS

To evaluate *QuantSys*, we conducted backtesting on historical stock market data and real-time testing with live market conditions. Key performance metrics include:

Accuracy of Predictions: Comparing predicted breakout points with actual market movements to assess the system's reliability. To assess the effectiveness of the EMA crossover strategy, we implemented and tested the EMA(2) versus EMA(10) crossover on the Nifty50 index using different timeframe data.

Table 1. Performance Evaluation of EMA(2) vs EMA(10) Strategy on Nifty50 (Daily Timeframe)

Total Predictions Made	35
Correct Predictions	19
Incorrect Predictions	17
Prediction Accuracy	54.29%

Table 2. Performance Evaluation of EMA(2) vs EMA(200) Strategy on Nifty50 (Daily Timeframe)

Total Predictions Made	14
Correct Predictions	5
Incorrect Predictions	9
Prediction Accuracy	54.29%

While the overall accuracy stands at around 54.29% and 64% across different timeframes, it's important to understand that making a profit in trading isn't just about having more correct predictions. A strategy can still be profitable even if it gets fewer trades right—what really matters is the risk-to-reward ratio. For example, a system with only a 40% success rate might actually perform better than one with a 60% win rate if the winning trades make significantly more than what the losing trades lose. In this case, the strategy maintained an average risk-to-reward ratio greater than 1:2, indicating that the average profit from winning trades was more than twice the average loss from losing trades. That's why it's essential to look beyond accuracy and also consider factors like average gain versus loss, trade sizing, and drawdown behavior to fully understand a strategy's potential profitability.

Real-time Effectiveness: Evaluated the response time and effectiveness of the Telegram notification system. Initial testing has shown promising results, with notifications being delivered in around 0.5 seconds after signal generation.

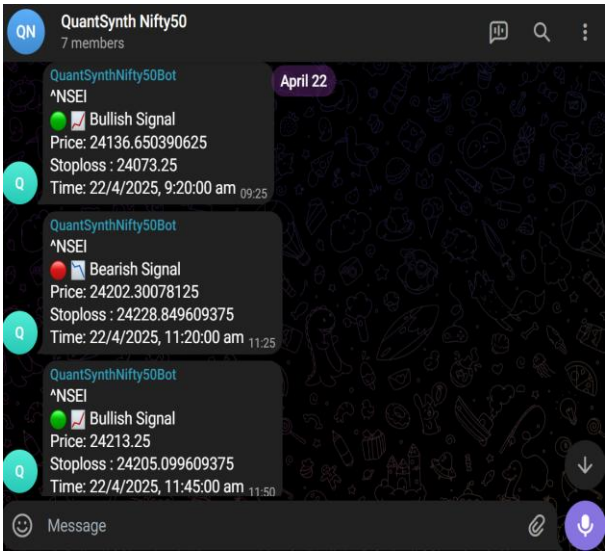

Fig 7: Example of Real-Time Trading Alert Output from QuantSys Telegram Bot Interface

5. CONCLUSION

QuantSys has proven to be a smart and dependable trading assistant that simplifies market analysis by combining real-time data with reliable technical indicators like Simple Moving Averages (SMA) and Exponential Moving Averages (EMA). It helps traders—whether beginners or experienced professionals—make quicker and more informed decisions while reducing the burden of manual analysis. With features like real-time Telegram alerts, users can act instantly on market opportunities without needing to constantly monitor charts. The system processes large volumes of data to identify actionable trends, improving trading accuracy and enabling better risk management. Looking ahead, *QuantSys* aims to evolve with powerful upgrades like dynamic adjustment of moving averages using AI for more responsive predictions. Enhancements also include support for cryptocurrencies, forex, and commodities, personalized strategy settings, and automatic trade execution through brokerage APIs. These additions are designed to make trading faster, smarter, and more accessible for users at every experience level. With these future additions, *QuantSys* is steadily transforming into a comprehensive, intelligent trading platform built to keep up with the fast-changing financial landscape.

6. ACKNOWLEDGMENTS

Sincere gratitude is extended to all those who supported and guided throughout the development of this project. Special acknowledgement is given to the project mentor, Prof. R.M. Samant, for his invaluable insights, continuous encouragement, and constructive feedback, which played a crucial role in shaping this work.

Appreciation is also directed to the faculty members of the Information Technology Department at NBN SINHGAD TECHNICAL INSTITUTE CAMPUS for providing the necessary academic foundation and technical support. Their guidance and resources were instrumental in the successful completion of this project.

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