OptionWise

The best Option Chain Tool for Traders

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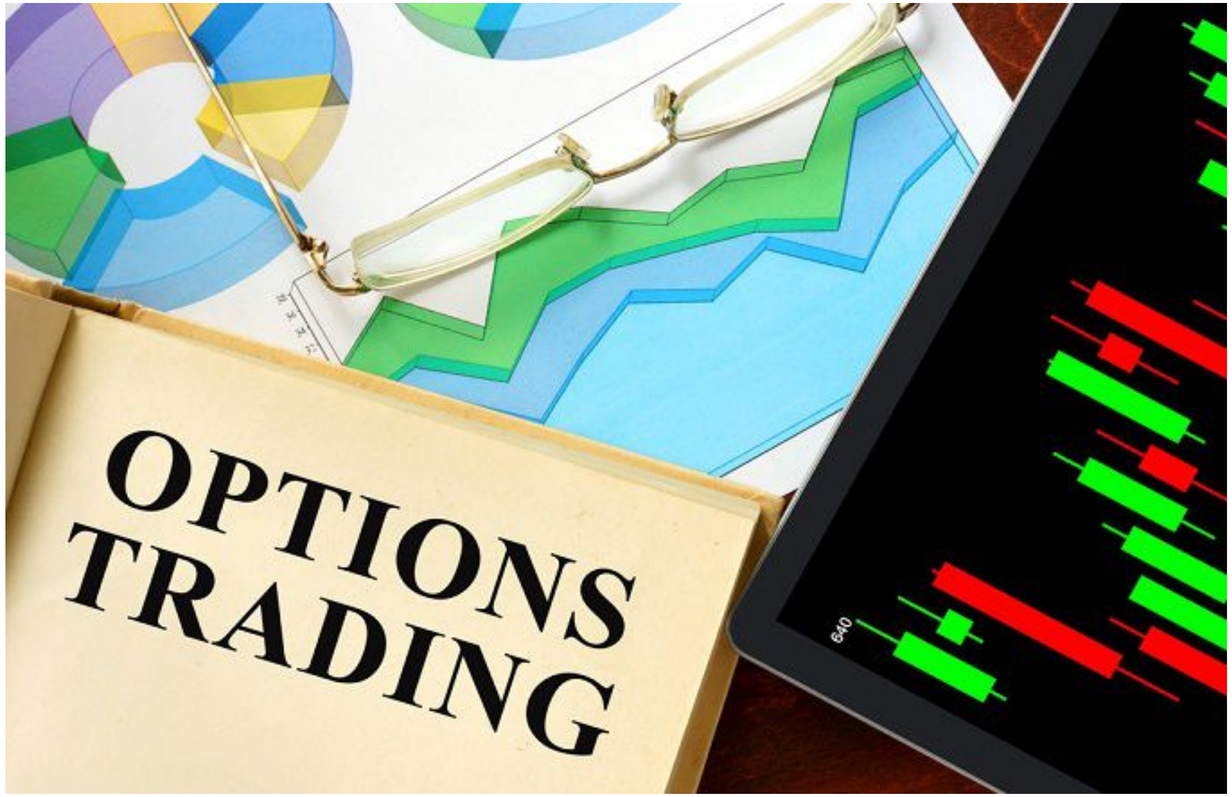
Introduction



Options trading is a financial derivative strategy that involves the buying and selling of options contracts. Options are contracts that give the holder the right, but not the obligation, to buy (call option) or sell (put option) an underlying asset, such as stocks, commodities, or currencies, at a predetermined price (strike price) within a specified period of time (expiration date).

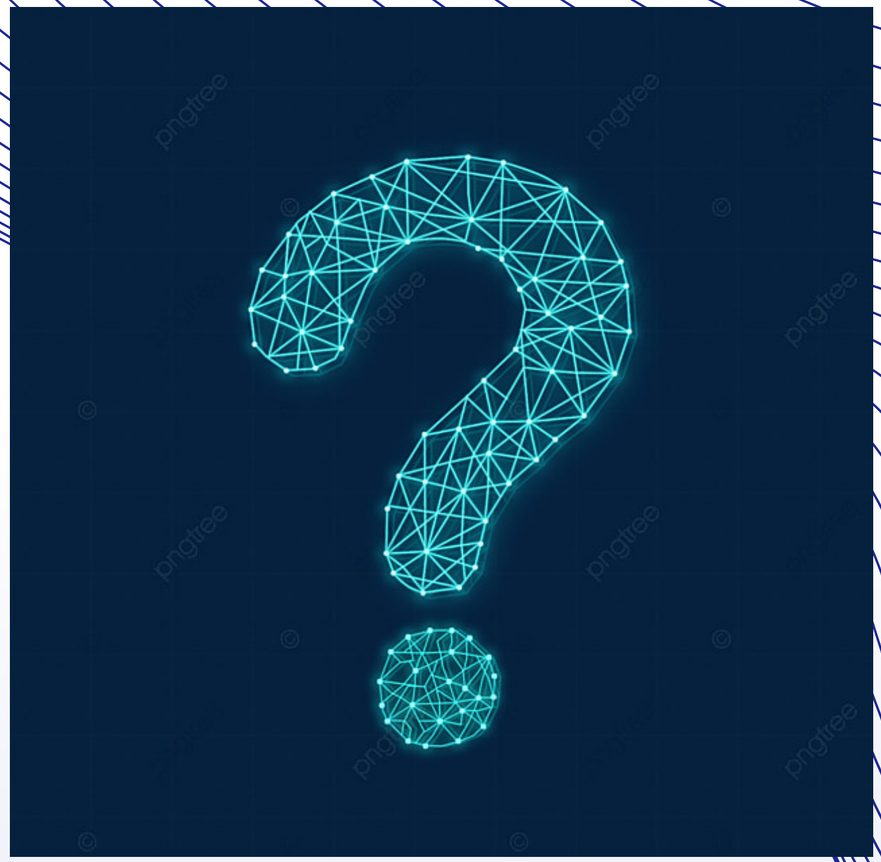
An option chain tool is a software application or platform that provides traders with a comprehensive view of available options contracts for a particular underlying asset. It displays a list of all available options, organized by expiration dates and strike prices, for both calls and puts.

A responsive option chain tool ensures that the displayed data is updated in real-time, allowing traders to access the most current information.

Problem Statement

Process a real-time market data stream and calculate Implied Volatility (IV) for options, displaying them as an options chain webpage.

The Option Chain should be responsive in Real-Time without having to refresh the page.
We will be using the Black-Scholes Formula to calculate Implied Volatality.
Highlight relevent options as ITM,ATM and OTM in the Option Chain



Objectives

- Develop a responsive web-based application to create an options chain screen resembling platforms like NSE India's option chain.
- Integrate with a market data stream over TCP/IP to receive real-time market data for underlying assets and options.
- Implement a user-friendly interface allowing selection of underlying assets and different expiry dates for options.

- Use the Black-Scholes formula to calculate implied volatility (IV) for each option based on provided option data.
- Highlight "in the money" and "out of the money" options using different visual cues or styling for easy identification.
- Continuously update the options chain in real-time as the market data changes, without requiring a browser reload.

Our Features

User Friendly UI

Our UI is good to look at and interactive.

Real-Time Changes

Do not need to refresh the page to depict most recent Data.

Informative

Provide clear differentiation between "in the money" and "out of the money" options for enhanced visibility.

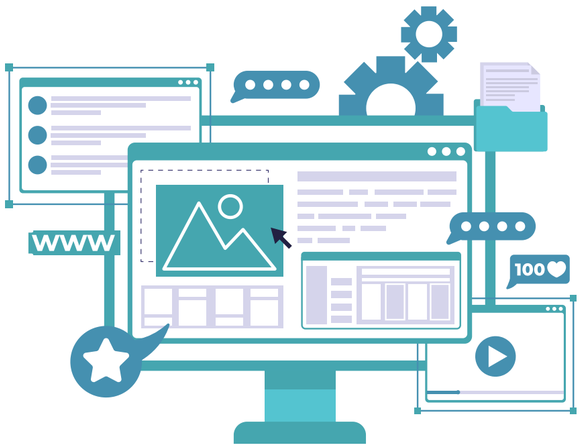
Insightful

Provides adequate and useful information to Traders.

Tech Stack

Backend-

- MongoDB
- Express
- Node JS



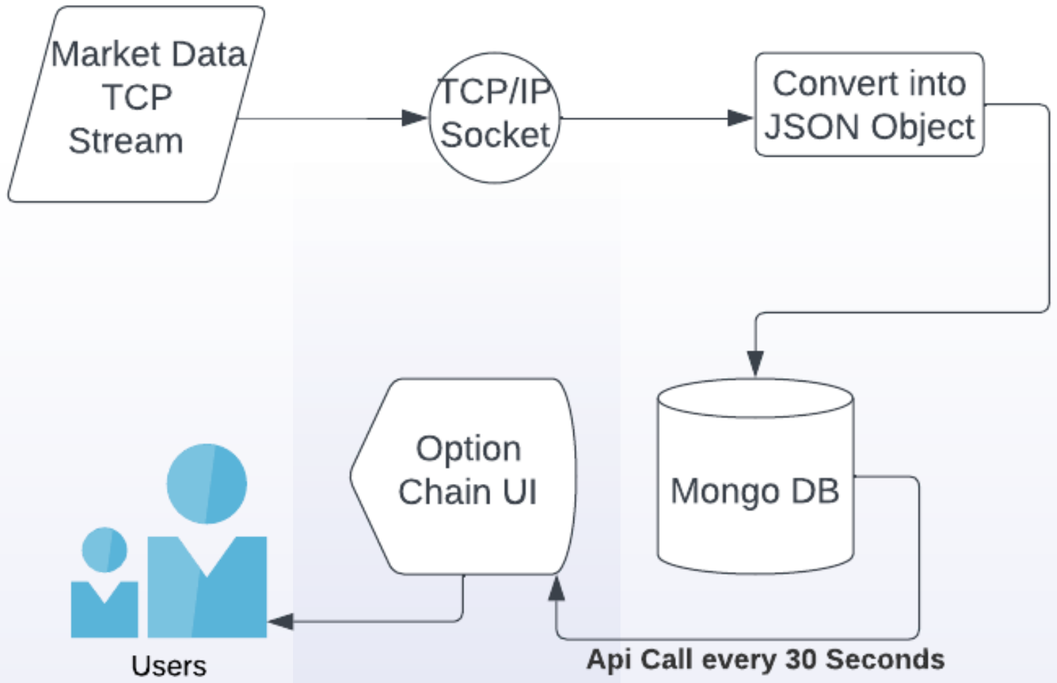
FrontEnd-

- React JS
- TypeScript

Collaboration-

Github

System Architecture



Data Preprocessing

We recieve data in this Format-

Publishing MarketData{symbol='MAINIDX06JUL23116750PE', LTP=125, LTQ=1850, totalTradedVolume=1850, bestBid=114, bestAsk=125, bestBidQty=5400, bestAskQty=4500, openInterest=6700, timestamp=Sat Jul 01 15:49:25 IST 2023, sequence=2598, prevClosePrice=48800, prevOpenInterest=18500}

We will split the Symbol as Follows-

Symbol- MAINIDX

Expiry Date- 06JUL23

Strike Price- 16750

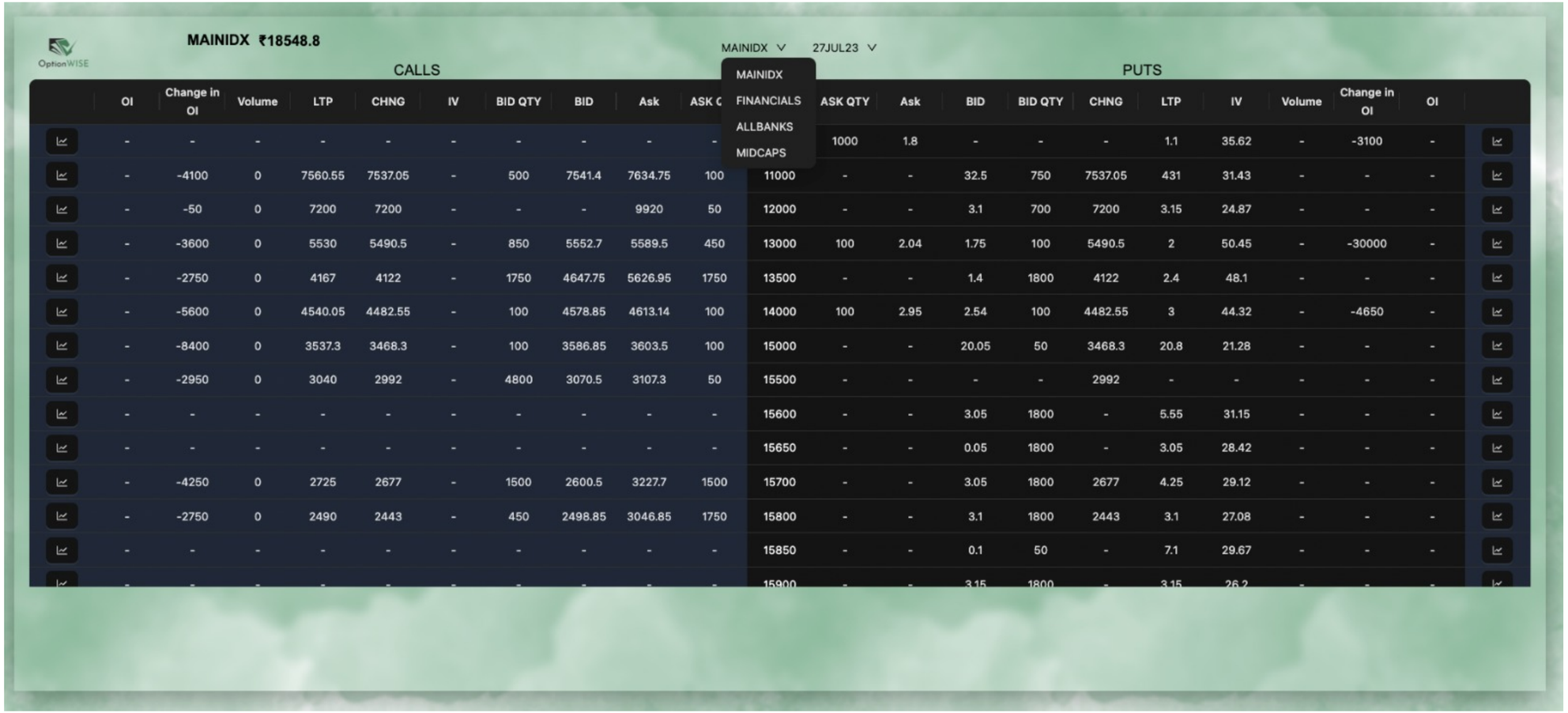
Option Type - PE

Data Model

Storing the Data in MongoDB

Fields	Datatype
Symbol	String
ExpiryDate	Number
Strike Price	Number
Option Type	String
Implied Volatility	Number
LTP	Number
LTQ	Number
Volume	Number
BestBid	Number
BestAsk	Number
AskQty	Number
OI	Number
Change in Open Interest	Number

User Interface



OI	Change in OI	Volume	LTP	CHNG	IV	BID QTY	BID	Ask	ASK Q		ASK QTY	Ask	BID	BID QTY	CHNG	LTP	IV	Volume	Change in OI	OI
-	-	-	-	-	-	-	-	-	-		1000	1.8	-	-	-	1.1	35.62	-	-3100	-
-	-4100	0	7560.55	7537.05	-	500	7541.4	7634.75	100	11000	-	-	32.5	750	7537.05	431	31.43	-	-	-
-	-50	0	7200	7200	-	-	-	9920	50	12000	-	-	3.1	700	7200	3.15	24.87	-	-	-
-	-3600	0	5530	5490.5	-	850	5552.7	5589.5	450	13000	100	2.04	1.75	100	5490.5	2	50.45	-	-30000	-
-	-2750	0	4167	4122	-	1750	4647.75	5626.95	1750	13500	-	-	1.4	1800	4122	2.4	48.1	-	-	-
-	-5600	0	4540.05	4482.55	-	100	4578.85	4613.14	100	14000	100	2.95	2.54	100	4482.55	3	44.32	-	-4650	-
-	-8400	0	3537.3	3468.3	-	100	3586.85	3603.5	100	15000	-	-	20.05	50	3468.3	20.8	21.28	-	-	-
-	-2950	0	3040	2992	-	4800	3070.5	3107.3	50	15500	-	-	-	-	2992	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	15600	-	-	3.05	1800	-	5.55	31.15	-	-	-
-	-	-	-	-	-	-	-	-	-	15650	-	-	0.05	1800	-	3.05	28.42	-	-	-
-	-4250	0	2725	2677	-	1500	2600.5	3227.7	1500	15700	-	-	3.05	1800	2677	4.25	29.12	-	-	-
-	-2750	0	2490	2443	-	450	2498.85	3046.85	1750	15800	-	-	3.1	1800	2443	3.1	27.08	-	-	-
-	-	-	-	-	-	-	-	-	-	15850	-	-	0.1	50	-	7.1	29.67	-	-	-
-	-	-	-	-	-	-	-	-	-	15900	-	-	3.15	1800	-	3.15	26.2	-	-	-

User Interface

OI	Change in OI	Volume	LTP	CHNG	IV	BID QTY	BID	Ask	ASK QTY	STRIKE	ASK QTY	Ask	BID	BID QTY	CHNG	LTP	IV	Volume	Change in OI	OI
-	-	-	-	-	-	-	-	-	-	10000	1000	1.8	-	-	-	1.1	35.62	-	-3100	-
-	-4100	0	7560.55	7537.05	-	500	7541.4	7634.75	100	11000	-	-	32.5	750	7537.05	431	31.43	-	-	-
-	-50	0	7200	7200	-	-	-	9920	50	12000	-	-	3.1	700	7200	3.15	24.87	-	-	-
-	-3600	0	5530	5490.5	-	850	5552.7	5589.5	450	13000	100	2.04	1.75	100	5490.5	2	50.45	-	-30000	-
-	-2750	0	4167	4122	-	1750	4647.75	5626.95	1750	13500	-	-	1.4	1800	4122	2.4	48.1	-	-	-
-	-5600	0	4540.05	4482.55	-	100	4578.85	4613.14	100	14000	100	2.95	2.54	100	4482.55	3	44.32	-	-4650	-
-	-8400	0	3537.3	3468.3	-	100	3586.85	3603.5	100	15000	-	-	20.05	50	3468.3	20.8	21.28	-	-	-
-	-2950	0	3040	2992	-	4800	3070.5	3107.3	50	15500	-	-	-	-	2992	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	15600	-	-	3.05	1800	-	5.55	31.15	-	-	-
-	-	-	-	-	-	-	-	-	-	15650	-	-	0.05	1800	-	3.05	28.42	-	-	-
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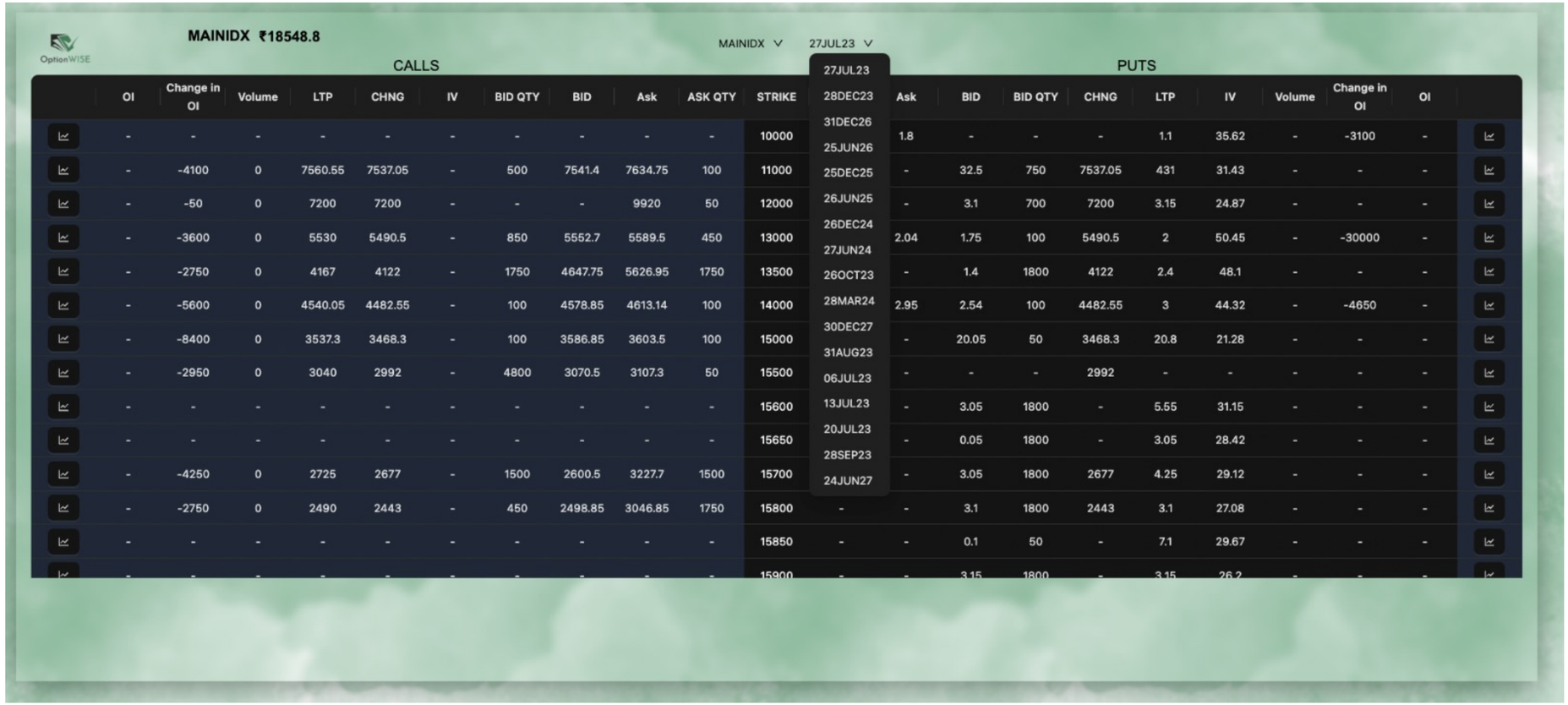
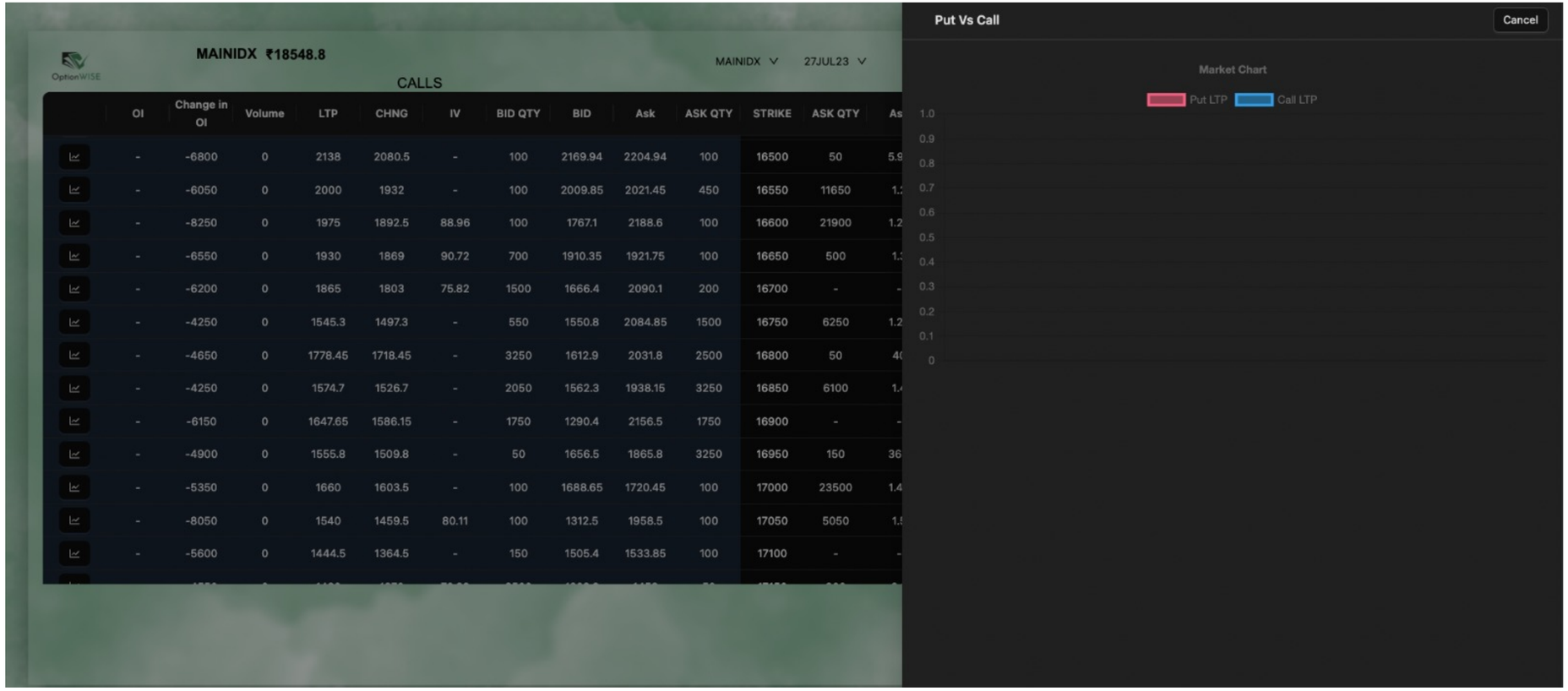
-	-2750	0	2490	2443	-	450	2498.85	3046.85	1750	15800	-	-	3.1	1800	2443	3.1	27.08	-	-	-
-	-	-	-	-	-	-	-	-	-	15850	-	-	0.1	50	-	7.1	29.67	-	-	-
-	-	-	-	-	-	-	-	-	-	15900	-	-	3.15	1800	-	3.15	26.2	-	-	-

User Interface



User Interface



The Black-Scholes Model

$$C = \Phi(d_1)S - \Phi(d_2)Ke^{-rt}$$

$$P = \Phi(-d_2)Ke^{-rt} - \Phi(-d_1)S$$

$$d_1 = \frac{1}{\sigma\sqrt{t}}\left[\ln\left(\frac{S}{K}\right) + \left(r + \frac{\sigma.^2}{2}\right)t\right]$$

$$d_2 = d_1 - \sigma\sqrt{t}$$

- C - price of call option
- P - price of put option
- S - stock price
- K - strike price
- t - time to expiration (years)
- r - risk-free rate (annualized)
- σ - implied volatility
- Φ - normal cumulative distribution function

Implied Volatility
Calculation

Implied volatility (IV) is a measure of the market's expectation of the future price fluctuations of an underlying asset. It is derived from the prices of options contracts traded in the market. Implied volatility reflects the perceived level of uncertainty or risk associated with the underlying asset's price movement over a specific period.

We have done this Calculation using the The Black-Scholes Model(Depicted In-Picture)

Newton-Rhaphson Method of Root Finding

- The Newton-Raphson method is an iterative numerical technique used to approximate the root of a function by repeatedly refining an initial guess based on the function's derivative and the discrepancy between the estimated and actual values.
- We use the Newton-Rhapson Method to estimate the Implied Volatility which is used in the Black Scholes Model.
- We basically take an assumed value of Volatility and keep iterating the Root Finding Algorithm until the Values of the actual Call/Put Price and the The estimated Call/Put price converge.

Algorithm for IV Calculation

1. Start with an initial guess value for **σ** (often the historical volatility or a value close to it).
2. Calculate d1 and d2 using the initial guess value.
3. Calculate the theoretical option price (C or P) using the Black-Scholes formula with the initial guess value of **σ**.

4.Compare the theoretical option price with the market price of the option.

5.Calculate the difference between the theoretical and market option prices (also known as the "option price error").

6.Use the option price error to adjust the value of **σ** using the Newton-Raphson formula:
σ_new = **σ**_old - (C_theoretical - C_market) / (Vega)

Repeat steps 2 to 6 iteratively until the option price error becomes small enough (usually within a predefined tolerance level).

The Calculated IV on convergence will be displayed on the Option chain.

Future Scope

- Infographics for Trading terms for better understanding of Users
- Support and Confidence Indicators for Options.
- Option Analysis Parameters(Greeks,charts etc.)