

StockOverflow: Simulate Market Trends

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PROBLEM

- Many finance educational applications lack in explaining real-world trends through mathematics.
- A lot of day-traders and investors seem to be unaware of the Brownian Motion equation which has been found to accurately simulate trends in the stock market.
- Many simulations that are currently popular do not reference, or properly indicate use of brownian motion.
- Through the use of sentiment analysis and NLP, the application can help users comprehend the affect of real-world events on the stock market.

CURRENT SYSTEM

- The current system's simulation engine ('/api/simulate' function) implements Geometric Brownian Motion. In order to properly simulate it, we must use a Geometric Brownian Motion equation that takes both drift (slope) and volatility (randomness) to account.

$$dS(t) = \mu S(t)dt + \sigma S(t)dW(t)^*$$

(where μ is drift and σ is volatility)

- The [Next.js](#) framework powers the application, the React front end fetches the JSON generated by the simulation and renders it as an interactive chart with Chart.js

REQUIREMENTS

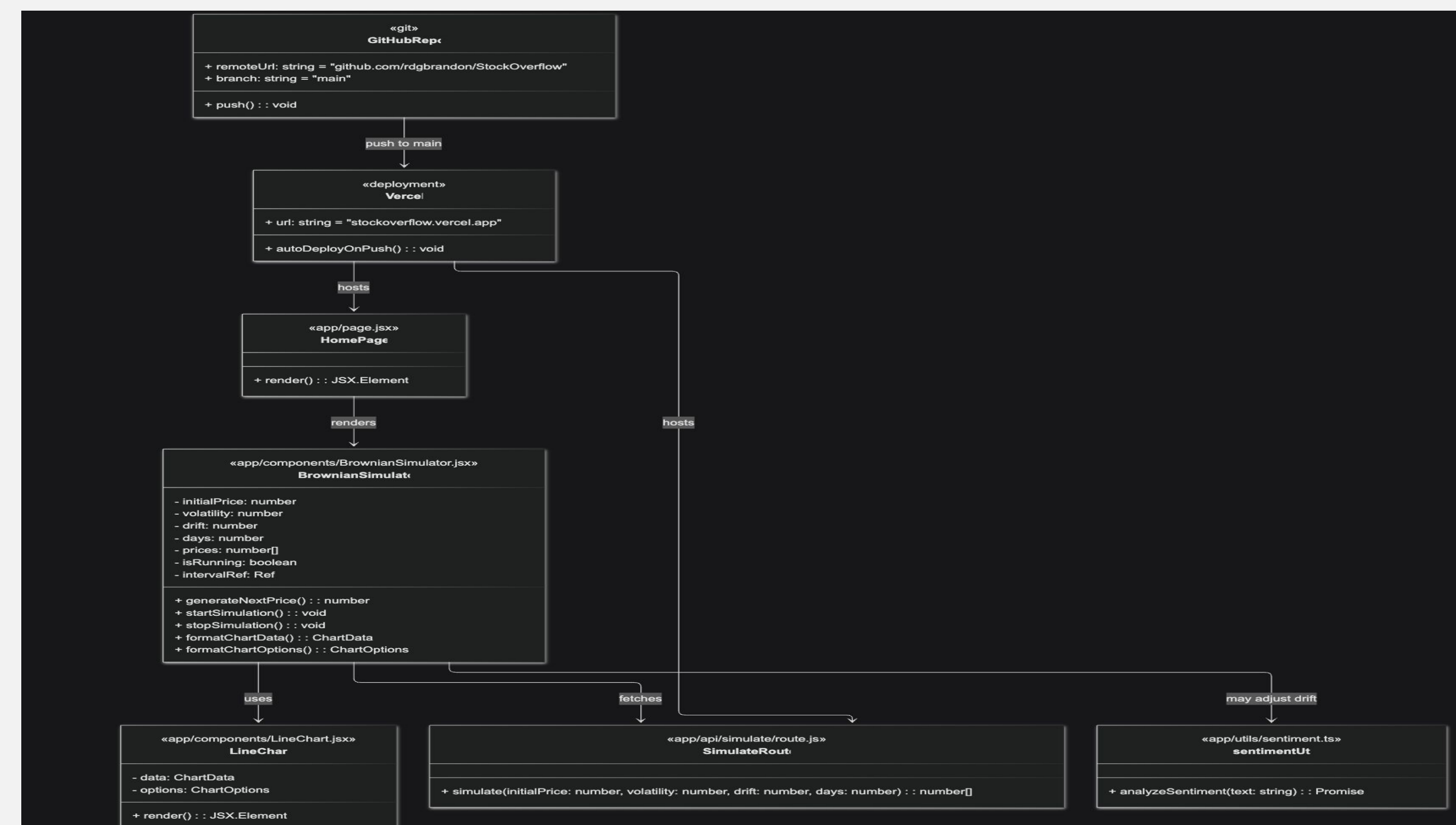
- *Node v16.16.0 (LTS)*
- *React 18.x*
- *GitHub*
- *Vercel (Hosting)*
- *[chart.js](#)*
- *huggingface*
- *ZeroShot Classifier (huggingface)*

SYSTEM DESIGN

- Our project focuses on two main features. We modeled our application's display of stock through brownian motion, and implemented a fetch button which will use metadata to collect yahoo finance data.
- If positive, the drift will become positive, meaning the stock price will have an increasing slope.
- If negative, the drift will become negative, meaning the stock price will have an increasing slope.
- An increase in the stock price will color the market line as green, where as a decrease in the stock price will color the market line as blue.
- The amount of days that the simulation will go through can be decided by the user.

/brownian endpoint will lead the user to the simulation.

OBJECT DESIGN



Full Diagram

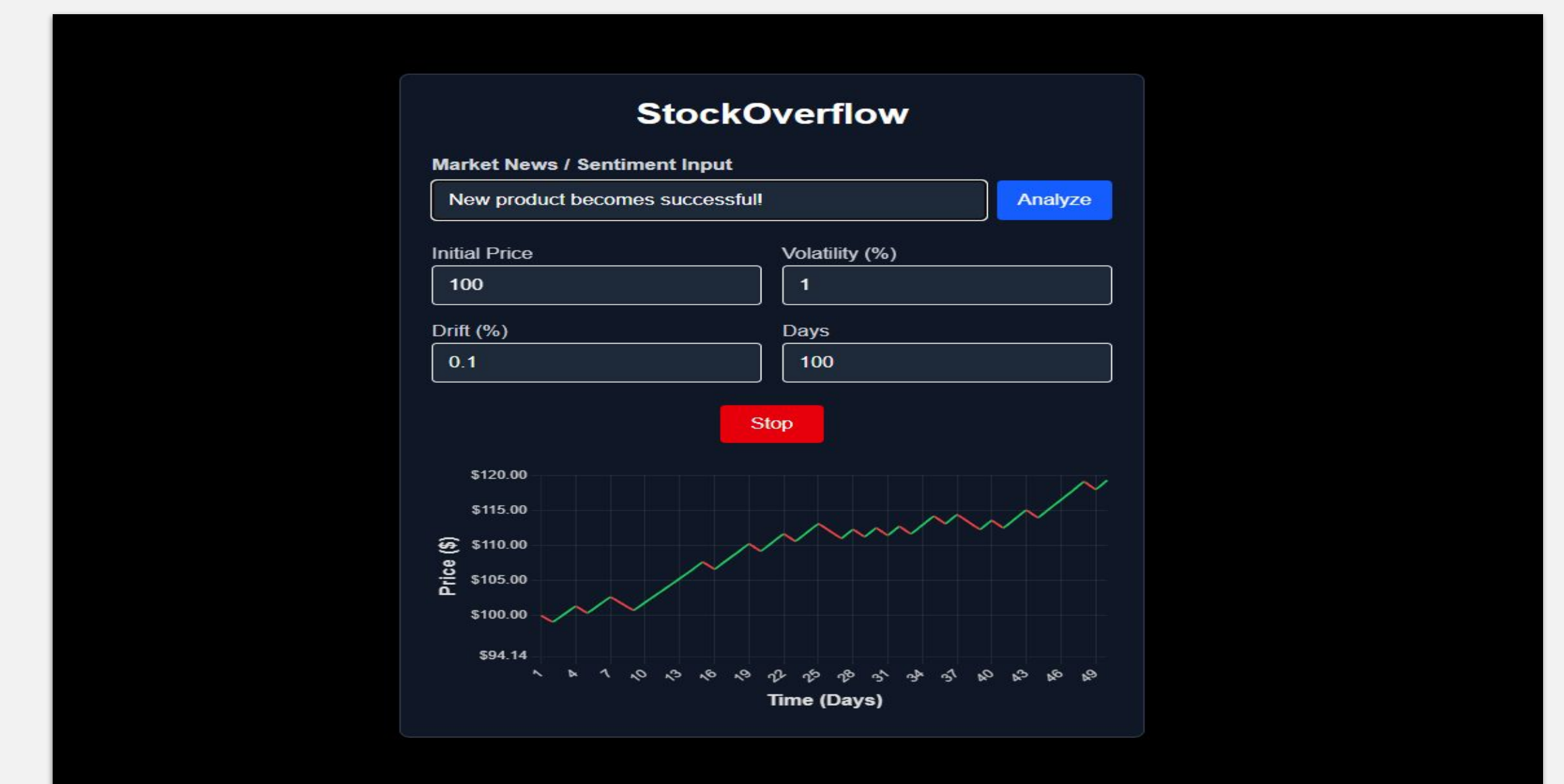
SUMMARY

This project aims to present a stock market simulation tool designated to make to connect the mathematical modeling with the real world financial education.

The application shows a problem in many finance app, which they often fail to simulate market behavior accurately using mathematical concepts like Geometric Brownian Motion. In most of the trading applications, GBM is irrelevant due to poorly explanation given its importance to the market behavior.

The interactive and educational approach of the StockOverflow allow users to understand how emotions and real-world of events would impact the market patterns.

IMPLEMENTATION



Through [next.js](#), we implemented a drift/volatility feature and a sentiment analysis feature to simulate change based on a given real-world event.

VERIFICATION

Our application successfully simulates a stock with a given start (USD), drift, volatility, and length (days). As shown through [IMPLEMENTATION], our application has a 2 second timer which updates the daily price of the stock. The fetch system was tested with multiple different stock symbols, which granted a 100% success rate.

REFERENCES

- <https://accountend.com/understanding-geometric-brownian-motion-theory-a-deep-dive/>
- <https://huggingface.co/docs/sagemaker/reference>
- <https://finance.yahoo.com/>