Homework 8: Ajax, JSON, Responsive Design and Node.js

Stock Search

(AJAX/JSON/HTML5/Bootstrap/Angular /Node.js/Cloud Exercise)

1. Objectives

- Get familiar with the AJAX and JSON technologies
- Use a combination of HTML5, Bootstrap and Angular on client side
- Use Node.js on server side
- Get familiar with Bootstrap to enhance the user experience using responsive design
- Get hands-on experience of Cloud services hosting NodeJS/Express
- Learn to use popular APIs such as finnhub API and Highcharts API

2. Background

2.1 AJAX and JSON

AJAX (Asynchronous JavaScript + XML) incorporates several technologies

- Standards-based presentation using XHTML and CSS
- Result display and interaction using the Document Object Model (DOM)
- Data interchange and manipulation using XML and JSON
- Asynchronous data retrieval using XMLHttpRequest
- JavaScript binding everything together

See the class slides at http://csci571.com/slides/ajax.pdf

JSON, short for JavaScript Object Notation, is a lightweight data interchange format. Its main application is in AJAX web application programming, where it serves as an alternative to the use of the XML format for data exchange between client and server. See the class slides at:

http://csci571.com/slides/JSON1.pdf

2.2 Bootstrap

Bootstrap is a free collection of tools for creating responsive websites and web applications. It contains HTML and CSS-based design templates for typography, forms, buttons, navigation, and other interface components, as well as optional JavaScript extensions. To learn more details about Bootstrap please refer to the lecture material on Responsive Web Design (RWD). You should use **Bootstrap 4+** and **ng-bootstrap** in this homework. See the class slides at:

http://csci571.com/slides/Responsive.pdf

2.3 Cloud Services

2.3.1 Google App Engine (GAE)

Google App Engine applications are easy to create, easy to maintain, and easy to scale as your traffic and data storage needs change. With App Engine, there are no servers to maintain. You

simply upload your application and it's ready to go. App Engine applications automatically scale based on incoming traffic. Load balancing, microservices, authorization, SQL and NoSQL databases, memcache, traffic splitting, logging, search, versioning, roll out and rollbacks, and security scanning are all supported natively and are highly customizable.

To learn more about GAE support for Node.js visit this page:

https://cloud.google.com/appengine/docs/standard/nodejs/

2.3.2 Amazon Web Services (AWS)

AWS is Amazon's implementation of cloud computing. Included in AWS is Amazon Elastic Compute Cloud (EC2), which delivers scalable, pay-as-you-go compute capacity in the cloud, and AWS Elastic Beanstalk, an even easier way to quickly deploy and manage applications in the AWS cloud. You simply upload your application, and Elastic Beanstalk automatically handles the deployment details of capacity provisioning, load balancing, auto-scaling, and application health monitoring. Elastic Beanstalk is built using familiar software stacks such as the Apache HTTP Server, PHP, and Python, Passenger for Ruby, IIS for .NET, and Apache Tomcat for Java.

To learn more about AWS support for Node.js visit this page:

https://aws.amazon.com/getting-started/projects/deploy-nodejs-web-app/

2.3.3 Microsoft Azure

Microsoft Azure is a cloud computing service created by Microsoft for building, testing, deploying, and managing applications and services through a global network of Microsoft-managed data centers. It provides software as a service (SaaS), platform as a service (PaaS) and infrastructure as a service (IaaS) and supports many different programming languages, tools, and frameworks, including both Microsoft-specific and third-party software and systems.

To learn more about Azure support for Node.js visit this page:

https://docs.microsoft.com/en-us/javascript/azure/?view=azure-node-latest

2.4 Angular

Angular is a toolset for building the framework most suited to your application development. It is fully extensible and works well with other libraries. Every feature can be modified or replaced to suit your unique development workflow and feature needs. Angular combines declarative templates, dependency injection, end-to-end tooling, and integrated best practices to solve development challenges. Angular empowers developers to build applications that live on the web, mobile, or the desktop.

For this homework, Angular 7+ (Angular 7, 8, 9 or 10) can be used, but **Angular 10 is recommended**. Please note Angular 7+ will need familiarity with Typescript and component-based programming.

To learn more about Angular 7+, visit this page:

https://angular.io/

2.5 Node.js

Node.js is a JavaScript runtime built on Chrome's V8 JavaScript engine. Node.js uses an event-driven, non-blocking I/O model that makes it lightweight and efficient. Node.js package ecosystem, **npm**, is the largest ecosystem of open-source libraries in the world.

To learn more about Node.js, visit:

https://Node.js.org/en/

Also, **Express.js** is strongly recommended. Express.js is a minimal and flexible Node.js web application framework that provides a robust set of features for web and mobile applications. It is in fact the standard server framework for Node.js.

To learn more about Express.js, visit:

http://expressjs.com/

Important Note: All APIs calls should be done through your Node.JS server

3. High-Level Description

In this exercise you will create a webpage that allows users to search for stocks using the Finnhub API and display the results on the search page. The application evolves from the previous homework.

A user will first open a page as shown below in **Figure 1**, where the user can enter a stock ticker symbol and select from a list of matching stock symbols using "autocomplete." A quote on a matched stock symbol can be performed. The description of the Search Box is given in **Section 3.1**. Instructions on how to use the API are given in **Section 4**. All implementation details and requirements will be explained in the following sections.

There are 4 routes for this application:

a) Home Route ['/'] redirected to ['/search/home']– It is a default route of this application.
b) Search Details Route ['/search/<ticker>'] – It shows the details of the <ticker> searched
c) Watchlist Route ['/watchlist'] – It displays the watchlist of the user.
d) Portfolio Route ['/portfolio'] – It displays the portfolio of the user.

When a user initially opens your web page, the initial search page should look like in **Figure 1**.

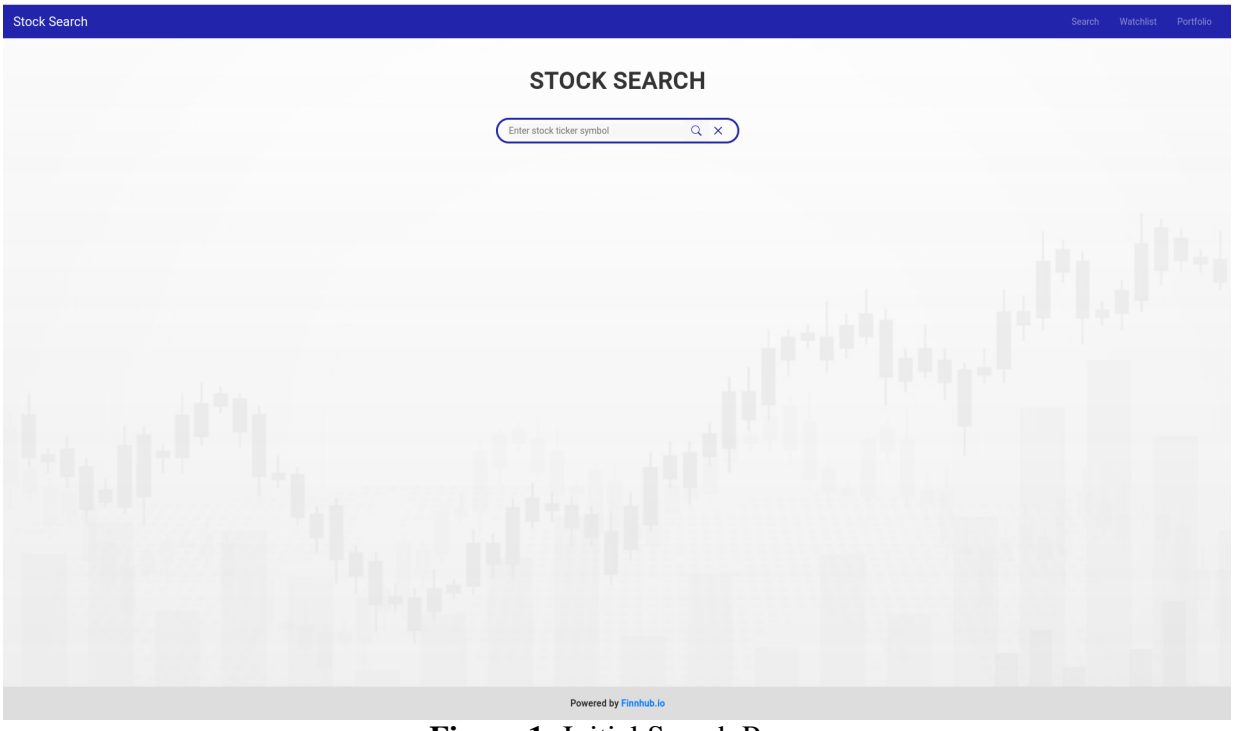


Figure 1: Initial Search Page

3.1 Search Page/ Homepage

3.1.1 Design

You must replicate the **Search Bar** displayed in **Figure 1** using a **Bootstrap form**. The Search Bar contains three components.

1. **Stock Ticker**: This is a text box, which enables the user to search for valid stocks by entering keywords and/or accepting a suggestion of all possible tickers. Notice the "helper" text inside the search box.
2. **Search Button**: The "Search" button (which uses the widely used search icon), when clicked, will read the value from the textbox and send the request to the backend server. On a successful response, details for that stock will be displayed.
3. **Clear button:** The 'clear' (cross marked) button, would clear out the currently searched results page and show the initial search page.

3.1.2 Search Execution

Search can be executed in the following ways:

1. Once the user enters a ticker symbol and directly presses the Return key or clicks on the "Search" button, without using the auto-complete suggestion, your application should make an HTTP call to the Node.js script hosted on GA/AWS/Azure back end (the Cloud Services). The Node.js script on Cloud Services will then make a request to the Finnhub API services to get the detailed information. If the entered ticker is invalid and no data is found, an appropriate error message should be displayed. If valid stock data is found, the search results should be loaded.
2. Once the user starts typing a ticker symbol, autocomplete suggestions (See **Section 3.1.3** below) will populate below the search bar. A matched ticker can be selected. Upon clicking the dropdown selection, the search should start automatically, and execute identically as described in the previous paragraph.

3.1.3 Autocomplete

A Search Bar allows a user to enter a keyword (Stock ticker symbol) to retrieve information. Based on the user input, the text box should display a list of all the matching company's ticker symbols with the company's name (see **Figure 2**). The autocomplete JSON data is retrieved from the ***Finnhub Search API*** (refer to **Section 4.1.4**).

The autocomplete response is filtered using the criteria: type= 'Common Stock', Symbol doesn't contain '.'(dot)

These are examples of calling this API:

```
https://finnhub.io/api/v1/search?q=<COMPANY_NAME>&token=<API_TOKEN>
# or
https://finnhub.io/api/v1/search?q=<SYMBOL>&token=<API_TOKEN>
```

```
For example:
https://finnhub.io/api/v1/search?q=apple&token=<API_TOKEN>
```

The autocomplete function should be implemented using **Angular Material**. Refer to Section 5.3 for more details.

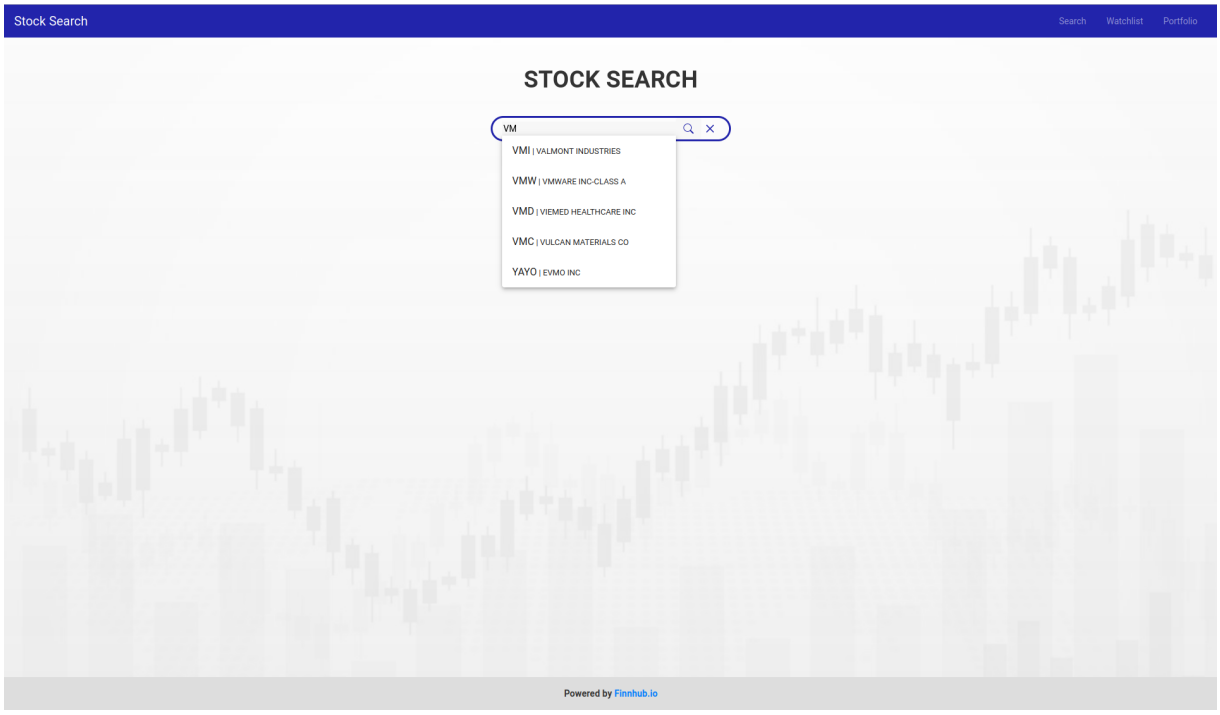


Figure 2: Autocomplete Suggestion

3.2 Search Results Page

3.2.1 Details of Searched Stock

After the user executes a search for a ticker, a page should route to /search/<ticker> path (example: /search/AMZN). The following components need to be displayed on successful search:

- Symbol, company name, trading Exchange (such as NASS+DAQ), and a Buy button on top left, The **Sell button should appear alongside the Buy button only when the portfolio has purchased stocks of a company. See Figure 3.3**;
- Last price, change, percent change, and date/time, on top right. The change items should be preceded by appropriately colored arrows;
- Company Logo and Indication of open / closed market in the top-center;
- Summary, Top News, Charts and Insights tabs.

IMPORTANT NOTE: If the user navigates to the watchlist route or the portfolio route, and navigates back to the search results page, the previously searched stock results should remain on the search/<ticker> route. Also, results data should be retrieved from a state/service and not be fetched from a new search API call.

Please refer to **Figures 3.1**, **3.2, 3.3** below.

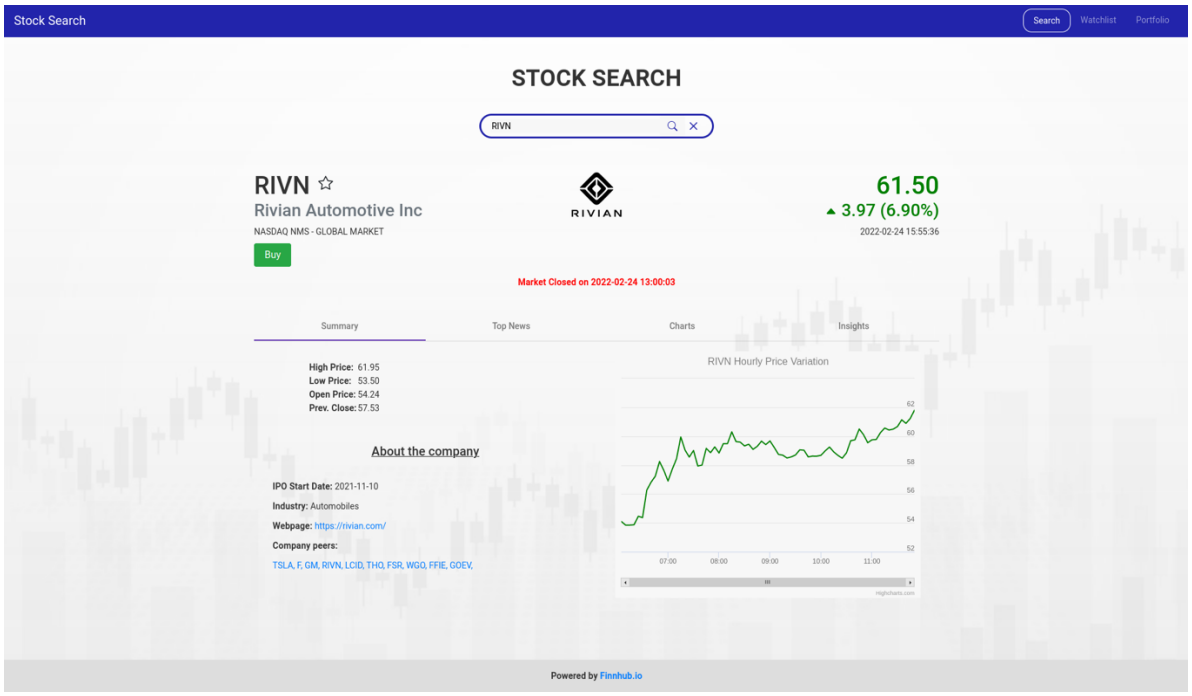


Figure 3.1: Search Details page overview (Market is Closed)

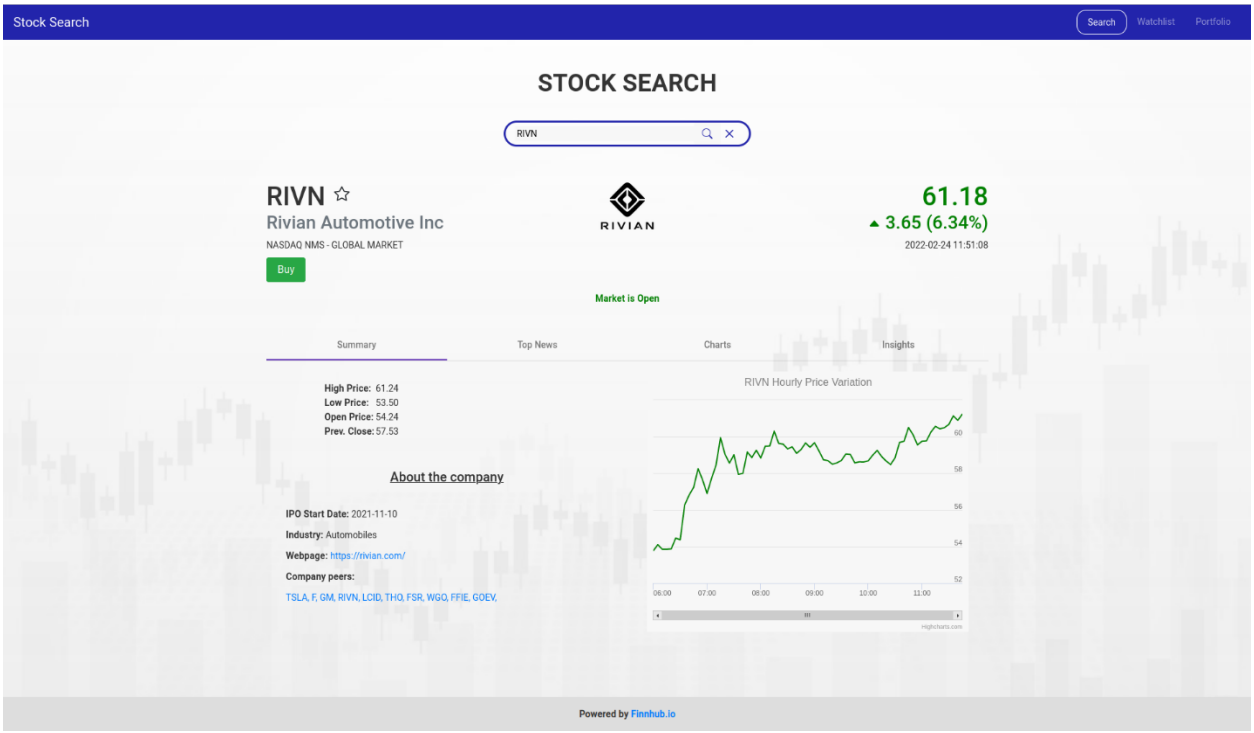


Figure 3.2: Search Details page overview (Market is Open)

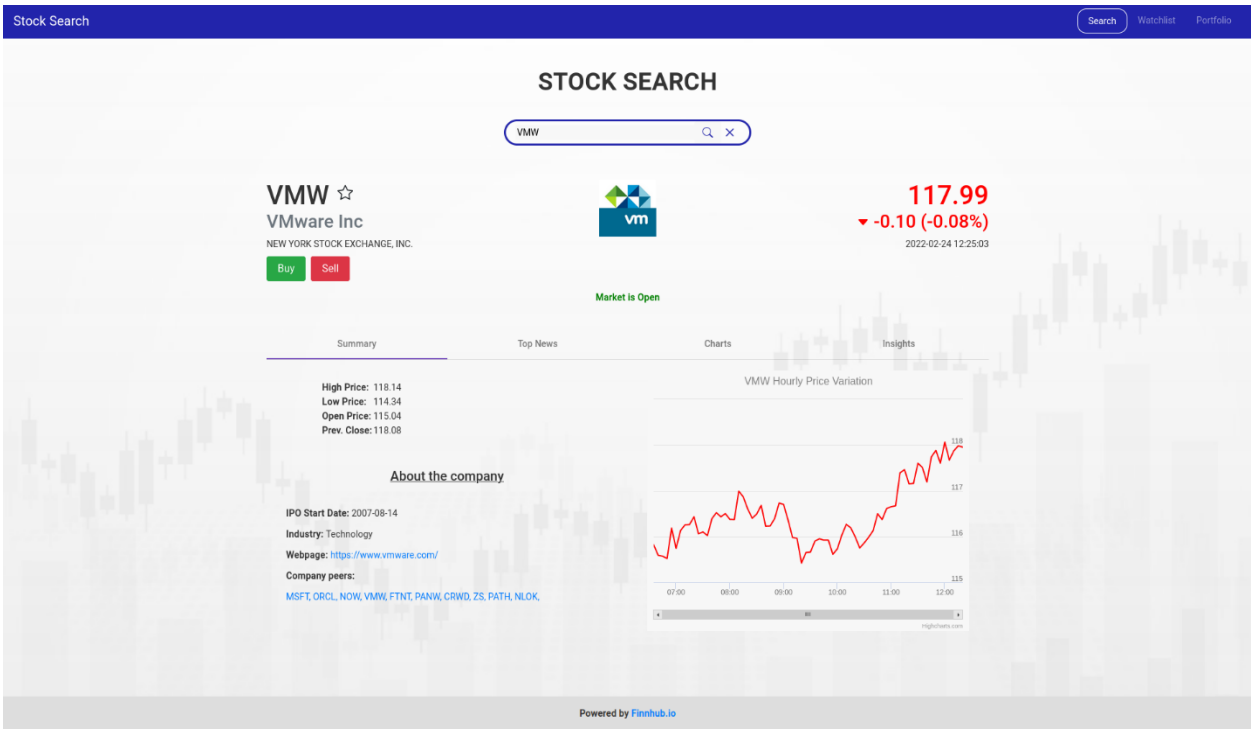


Figure 3.3: Search Details page overview (Dynamic sell button when the portfolio has purchased stock of the company)

- When the user clicks on the star icon, the white star turns yellow, and that ticker should be stored in local storage (see HTML5 localstorage). A self-closing alert should be displayed at the top and that stock should be visible on the Watchlist Page (see **Section 3.3**).
- When the user clicks on the **Buy** button, a modal window should open. which will display the details (stock symbol, current price, money in wallet, input for quantity of shares to buy and total price for the shares), as shown in Figure 3.5. Note that:
    - The **Buy** button should be disabled if the user inputs a quantity < 1 or the quantity field is empty or the quantity leading to total more than money in wallet (see **Figure 3.5**);
    - The **Buy** button will be enabled once the user enters a number greater than 0 and suitable quantity up to total equals (or less than) money in wallet (see **Figure 3.4**).
- The **Sell** option is available in the homepage only when there is at least 1 quantity of stock available in portfolio. Upon clicking the **Sell** button, similar behavior as the buy transaction should be implemented, along with the constraint being able to sell only the stocks owned.
- **Error messages** should be shown for an attempt to buy more than the possible quantity of stocks using the money in wallet/attempt to sell more than the number of stocks owned in Portfolio. See Figure 3.5 for reference.
- A self-closing transaction **alert message** should be shown for both buy and sell transactions as in **Figure 3.4a**.

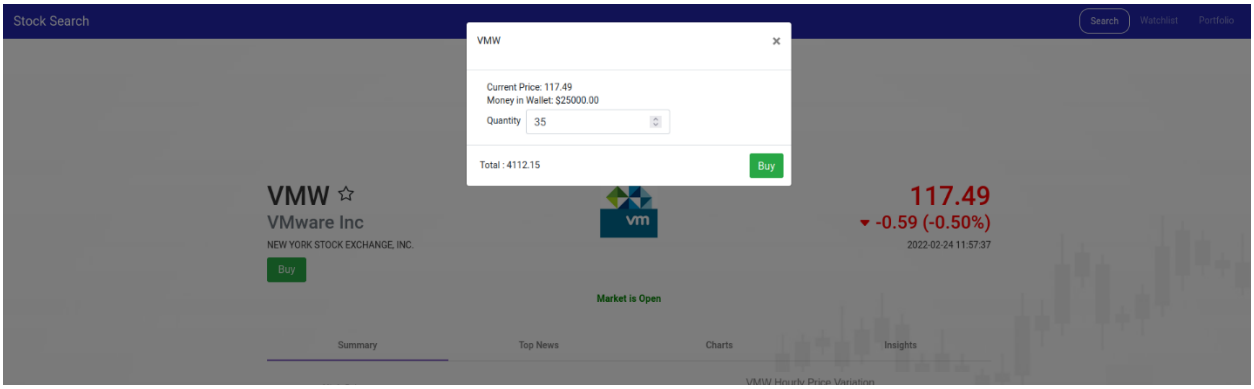


Figure 3.4: Buy Button enabled for valid input

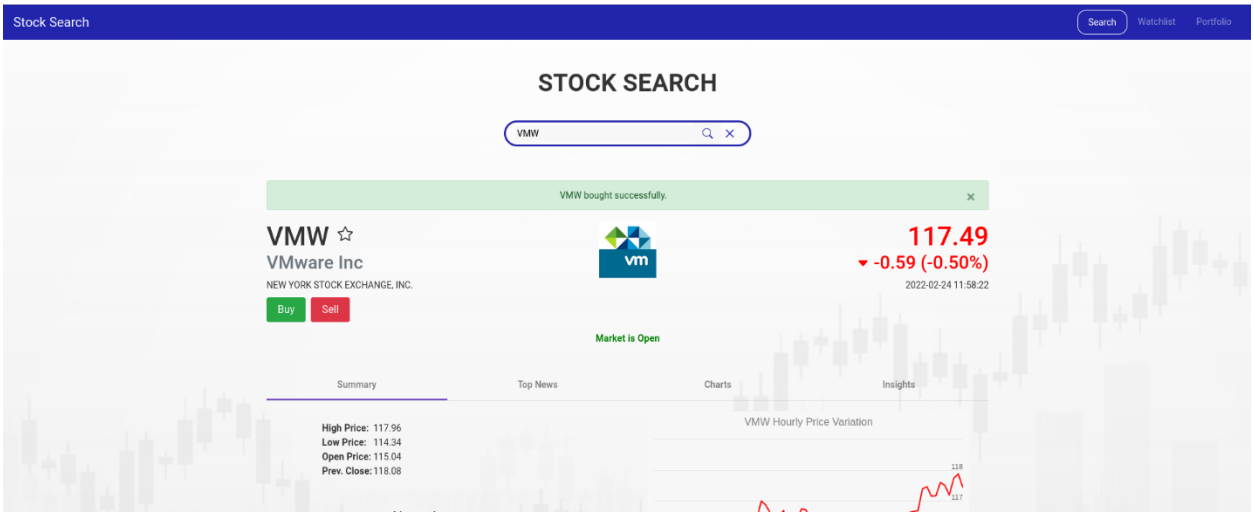


Figure 3.4a: Alert for buying stock successfully

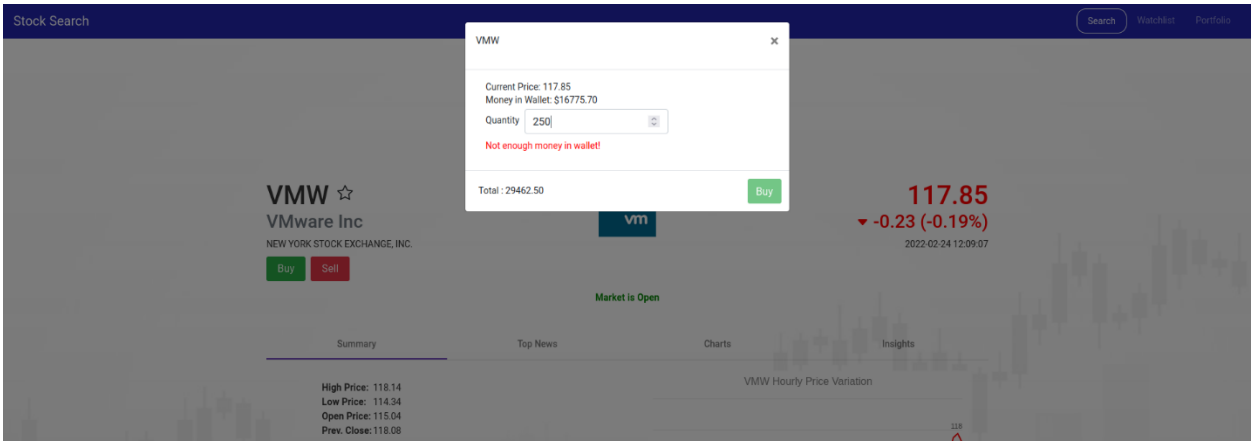


Figure 3.5: Buy button disabled for invalid input

For details and screenshots of similar sell transaction, refer **Section 3.4 (Portfolio).**
As described, the page contains two major panels:

1) **Stock Details**: This panel displays all the values mentioned in **Table 3.1**. Last Timestamp should be only displayed beside the Market status if "Market is Close".

Fields	Sample Values	API reference
Ticker	VMW	From table 4.1, use 'ticker' key
Company's Name	VMware Inc.	From table 4.1, use 'name' key
Exchange Code	New York Stock Exchange, Inc	From table 4.1, use 'exchange' key
Last Price	126.99	From table 4.3, use 'c' key
Change	1.09	From table 4.3, use 'd' key
Change Percentage	0.86%	From table 4.3, use 'dp' key
Current Timestamp	2022-02-17 09:02:21	From table 4.3, use 't' key
Market Status	Open/Close	Calculation from timestamp

Table 3.1 – Stock Details

2) **Material Tabs** – This component helps users see different stock data on the same page, and the content of the tabs is detailed in the following sections.

IMPORTANT NOTE: All numerical values should be rounded off to 2 decimal places.

Data mentioned in the Stock Details section and Summary Tab, should auto-update every 15 seconds.

3.2.2 Summary Tab

This tab contains a summary of the stock, which includes:

- Details, as follows:
  - Calculate if the market is open, using the timestamp key in **Table 3.2.** The value of 't' is the last timestamp at which the stock details are available. Assume the market is closed if more than 5 minutes has elapsed from this 't' value. Assume the market is open, if otherwise.
  - If the market is open: display all the fields mentioned in **Table 3.2 and Table 3.3**, as shown in **Figure 3.2**.
  - If the market is closed: Display all the fields mentioned in **Table 3.2 and Table 3.3**, as shown in **Figure 3.1**.
- About the Company: values from **Table 3.3.**
- Chart for the last Working Day:
  - See **Section 4.1.2** to obtain hourly stock price data using resolution '5' and show variation for the last 6 hours.
  - If market is open: show stock price variation from current time.
  - If market is closed: show stock price variation from when the market was closed. (i.e., last working day).

Fields	Sample Values	API reference
High Price	128	From table 4.3, use ‘h’ key
Low Price	124.90	From table 4.3, use ‘l’ key
Open Price	125	From table 4.3, use ‘o’ key
Prev. Close	125.90	From table 4.3, use ‘pc’ key
Timestamp	1645218002	From table 4.3, use ‘t’ key

Table 3.2: Fields used inside Summary Tab (Part 1)

Fields	Sample Values	API reference
IPO Start Date	2007-08-14	From table 4.1, use ‘ipo’ key
Industry	Technology	From table 4.1, use ‘finnhubIndustry’ key
Webpage	https://www.vmware.com/	From table 4.1, use ‘weburl’ key
Company Peers	MSFT, ORCL, NOW, VMW	From table 4.8, use response list

Table 3.3: Fields used inside Summary Tab (Part 2)

Important Note: The list of company peers should be clickable links which should navigate to the search results of that ticker

3.2.3 Top News Tab

This tab shows top news for the given stock ticker symbol (see **Figure 3.6** and **Figure 3.7**). In particular:

- Show cards which contains Image and Title.
  - For Image use ‘image’ key from **Table 4.5**.
  - For Title use ‘title’ key from **Table 4.5**.
- When clicking on a on card, open a Modal window as shown in **Figure 3.7**. For details regarding Modal check Section 5.3. Modal contains all the fields mentioned in **Table 3.4**.
- Users can share the news articles on Twitter and Facebook. For details on how to use it, check **Section 4.2**. Twitter and Facebook should open in a new browser tab, if clicked.
  - In Twitter, it should create a post having following content:
    - Title of the news article
    - URL of the news article.
  - In Facebook, it should create a post, which contains URL of the news Article.
- Inside modal when user clicks on ‘***here***’ in ‘*For more details click* ***here***’, it should open the URL for the article in a new browser tab.

Fields	API reference
Source	From Table 4.5, use ‘source’ key.
Published Date	From Table 4.5, use ‘datetime’ key.
Title	From Table 4.5, use ‘headline’ key.
Description	From Table 4.5, use ‘summary’ key.
URL	From Table 4.5, use ‘url’ key.

Table 3.4: Fields used inside modal of Top News Tab

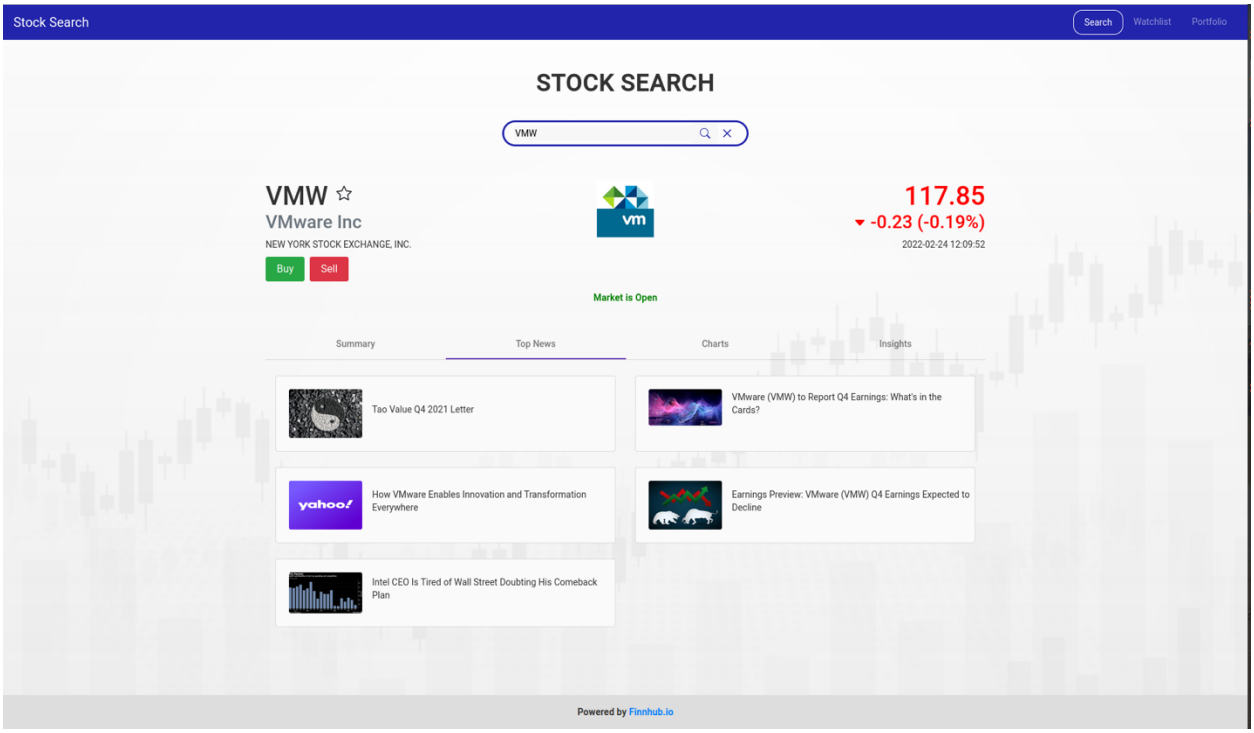


Figure 3.6: Top News Tab overview

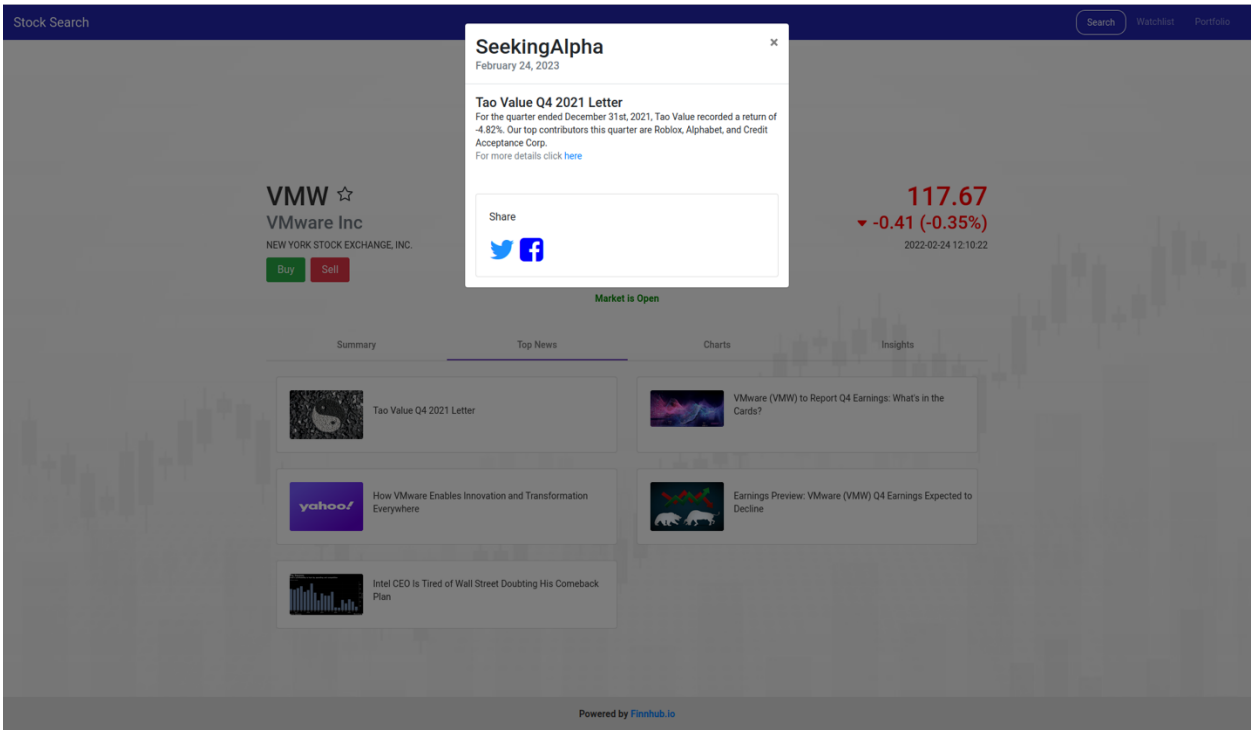


Figure 3.7: Top News Detailed Modal overview.

3.2.4 Charts Tab

This tab uses HighCharts to display historical stock market data on the related stock. In particular:

- See **Figure 3.8** for reference using **Section 4.1.3** implementation.
- For more details regarding Highcharts see **Section 5.5**.
- Display SMA and Volume by Price charts for data of the last 2 years.

Figure 3.8: Charts tab overview.

3.2.5 Insights Tab

This tab uses a table that contains fields as mentioned in **Table 3.5** and HighCharts to display recommendation trends and company earnings data on the related stock. In particular:

- See **Figure 3.9** for reference using **Section 4.1.7 and Section 4.1.9**.
- Aggregate the response data from **Section 4.1.7** for all reddit and twitter mentions and display in table.
- For more details regarding Highcharts see **Section 5.5**.

Fields	API reference
Total Mentions – Reddit	From Table 4.7, use ‘mention’ key.
Positive Mentions – Reddit	From Table 4.7, use ‘positiveMention’ key.
Negative Mentions – Reddit	From Table 4.7, use ‘negativeMention’ key.
Total Mentions – Twitter	From Table 4.7, use ‘mention’ key.
Positive Mentions – Twitter	From Table 4.7, use ‘positiveMention’ key.
Negative Mentions – Twitter	From Table 4.7, use ‘negativeMention’ key.

Table 3.5: Fields used inside table of Insights Tab

IMPORTANT NOTE: ‘Total’ calculation to be made appropriately for all fields from the array of response obtained (see **Section 4.1.7**).

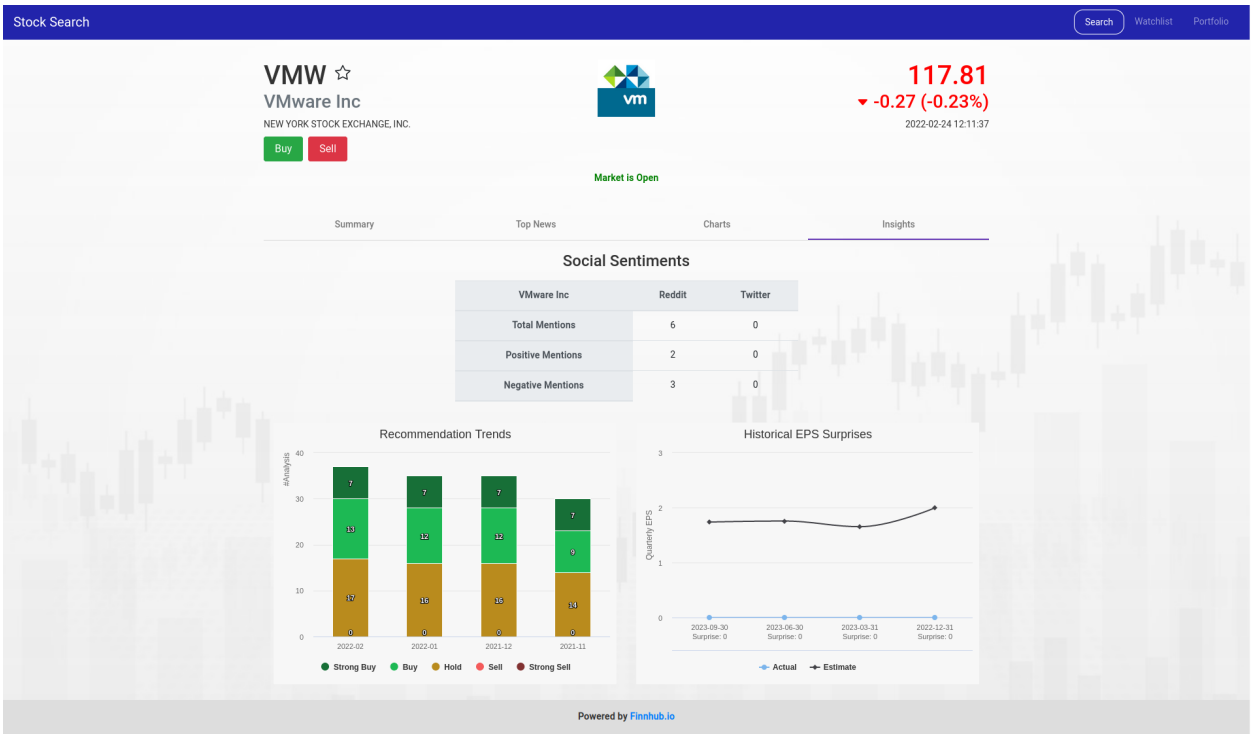


Figure 3.9: Insights tab overview.

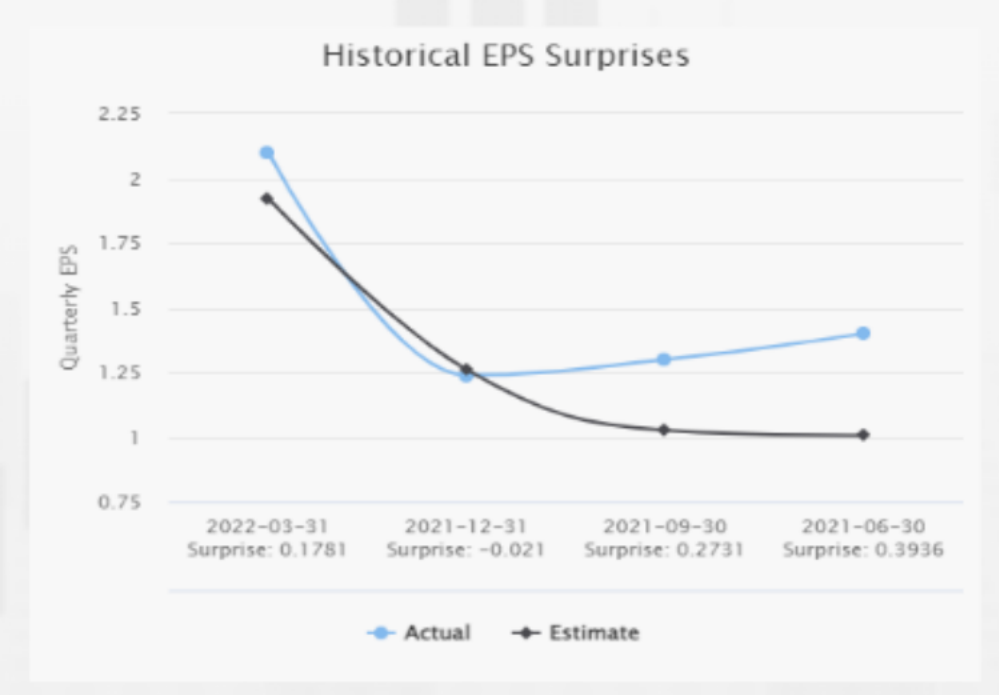


Figure 3.9a: Company Earning chart with non-null values

IMPORTANT NOTE: An error message to be shown as shown below, if the user did not enter input in the search box or no data is found for the entered input. Use the company profile response to determine no data.

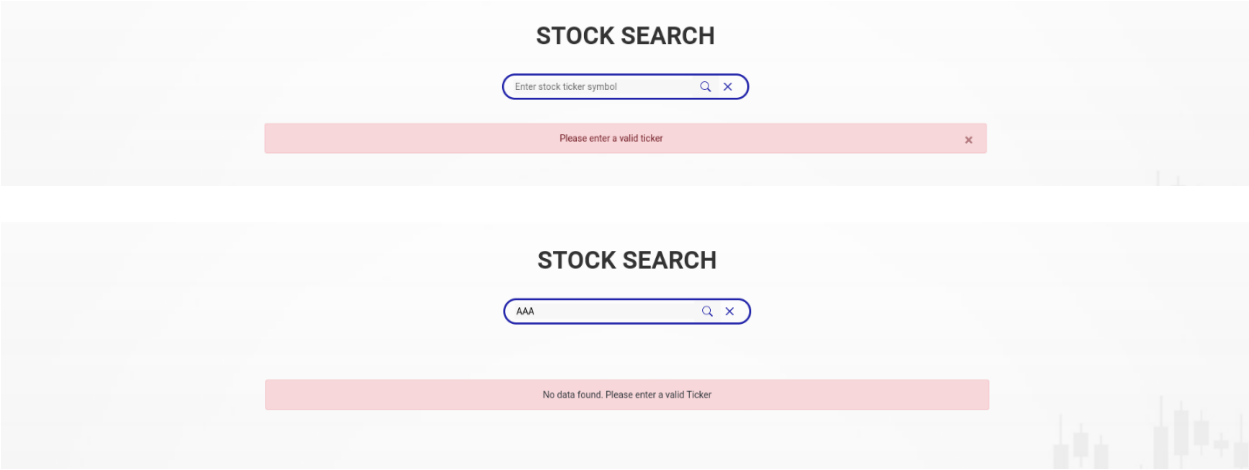


Figure 3.10: Error Alert.

3.3 Watchlist Menu

This menu will display all the stocks that are added to the watchlist by the user. This watchlist will be maintained in local storage of the application. For more details on local storage, see **section 5.4** and **Figure 3.11**.

- If the change is positive, the color of the 'c', 'd' and 'dp' keys should be green
- If the change is negative, the color of the 'c', 'd' and 'dp' keys should be red
- If there is no change, the color of the 'c', 'd' and 'dp' keys should be black.
- When clicked on close button at present on the right-top corner of the card, it should remove it from the watchlist and display an updated watchlist.
- When clicked on card, it should open the details route of that ticker (stock).
- If watchlist is empty, it should display the alert as shown in **Figure 3.12**.

'c', 'd' and 'dp' key should be used from **Table 4.3**.

NOTE: 'percentage change' should be rounded off to 2 decimal places.

Upon clicking any area of the watchlist card, user should be navigated to the search details page of that stock

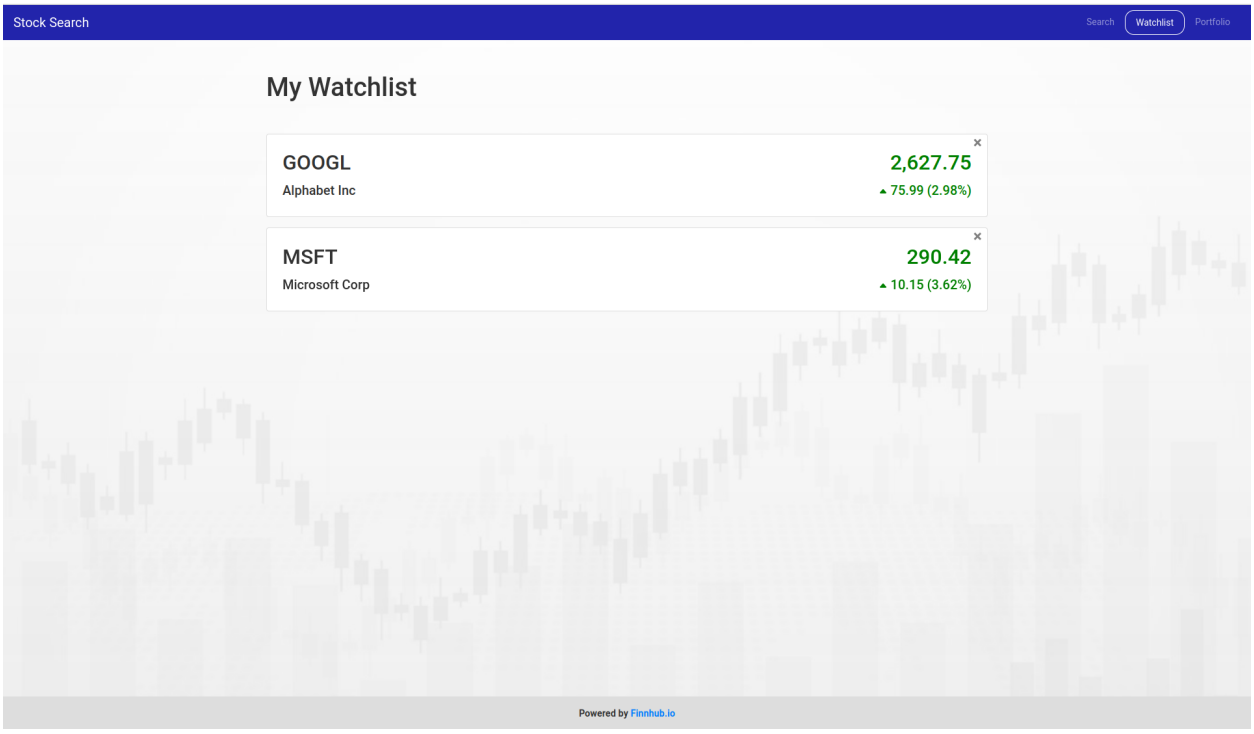


Figure 3.11: Watchlist menu page

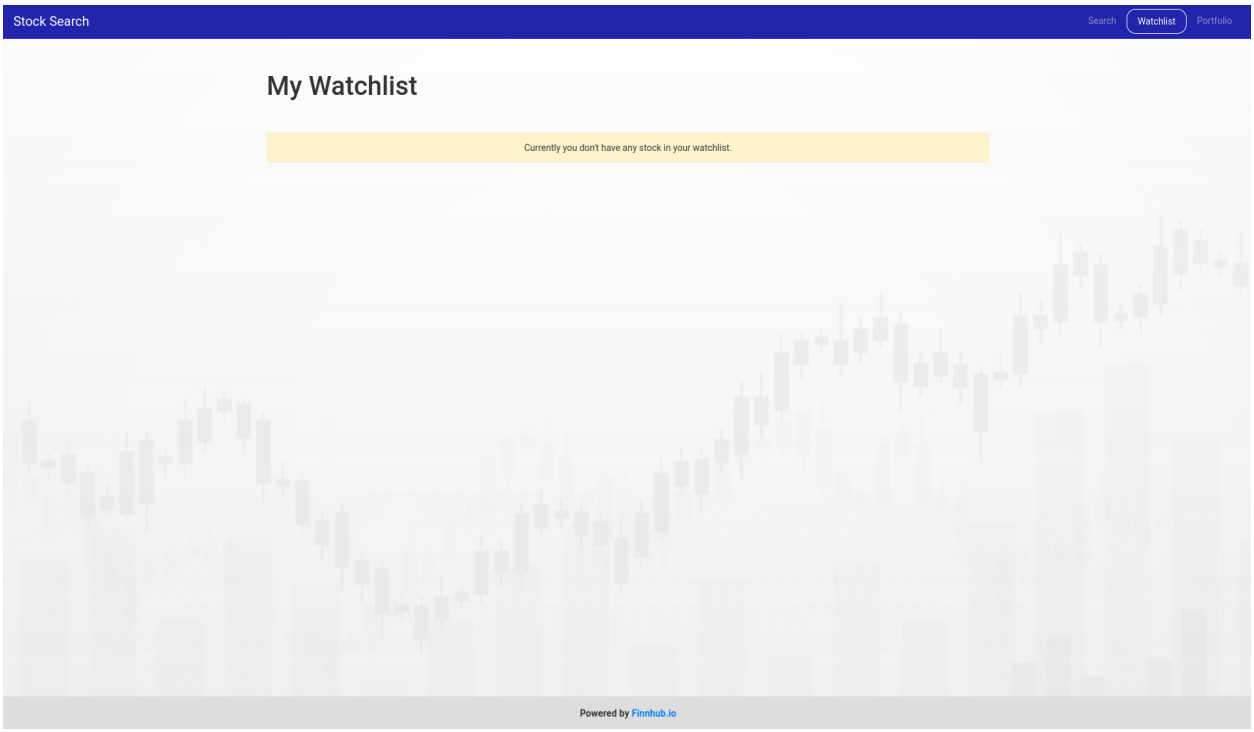


Figure 3.12: Watchlist Empty Alert

3.4 Portfolio Menu

This menu will display all the stocks that have been bought by the user (i.e., the current portfolio of the user). This portfolio will be maintained in the local storage of the application. For more details on local storage, see **Section 5.4** and **Figure 3.13**.

To simulate real-world stock trading and allow the user to make profits/losses, a wallet feature should be implemented. Initialize the money in wallet to be $25000 using local storage. User can use this money to trade stocks.
Update the money spent and gained during buy and sell transactions, accordingly. Initial price of stock when buying it, and the current change in price should be used to update money in wallet for profit and loss.

In particular:

- If the current rate is greater than the rate at which user bought it, then color of the 'Change', 'Current Price' and 'Current Total' keys should be green;
- If the change is negative, the color of the 'Change', 'Current Price' and 'Current Total' keys should be red;
- If there is no change, the color of the 'Change', 'Current Price' and 'Current Total' keys should be black;
- When clicking on **Buy** button, modal should open as shown in **Figure 3.15**. The Buy button inside modal should be disabled if the quantity entered by user is not valid as shown in **Figure 3.14**. Valid input should be greater than 0 and quantity that produces total less than money in wallet and must be non-empty;

- When clicking on **Sell** button, modal should open as shown in **Figure 3.17 and 3.18**. Sell button inside modal should be disabled if the quantity entered by user is not valid. Input is Valid if, 0<input<=Quantity and must be non-empty. Quantity is described in **Table 3.6**;
- When clicked on card's header part, it should open the search details route of that ticker (stock);
- If portfolio is empty, it should display the alert as shown in **Figure 3.14**.

'c' key should be used from Table 4.3 for 'Current Price'. 'Current Change' and 'Current Total' should be calculated as shown in **Table 3.5**.

Quantity	Total Number of stocks bought by user. It should be more than 0, else remove it from the portfolio local storage.
Total Cost	Total cost is sum of the total cost paid for all the purchases of the stock. For Example, if user has bought 10 stocks of AAPL in past, at the rate of 200, and today if user buys another 10 stocks of AAPL at the current price, i.e. 300, then the Total Cost for the user will be (10*200) + (10*300) = 5000. So Quantity is 20 and Total Amount is 5000.
Average Cost per Share	(Total Cost / Quantity)
Current Price	'c' key from the table 4.3
Change	(Average Cost per Share – Current Price) of the stock. Here, Current Price is 'c' key from the table 4.3
Market Value	(Current Price * Qty), here Current Price is 'c' key from **Table 4.3** and Qty is the number of stocks present in user's portfolio.

Table 3.6: Fields used in Portfolio Cards.

Alerts should be displayed for successful buy and sell transactions, which should auto-close.

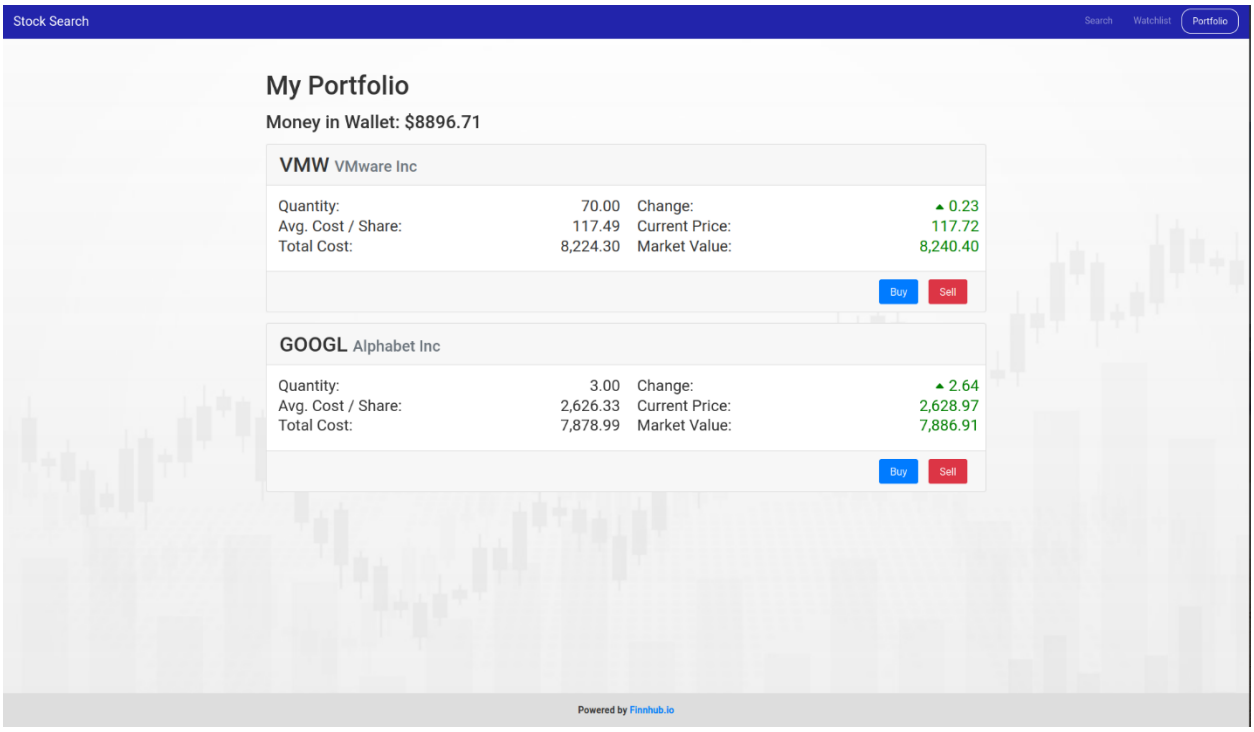


Figure 3.13: Portfolio

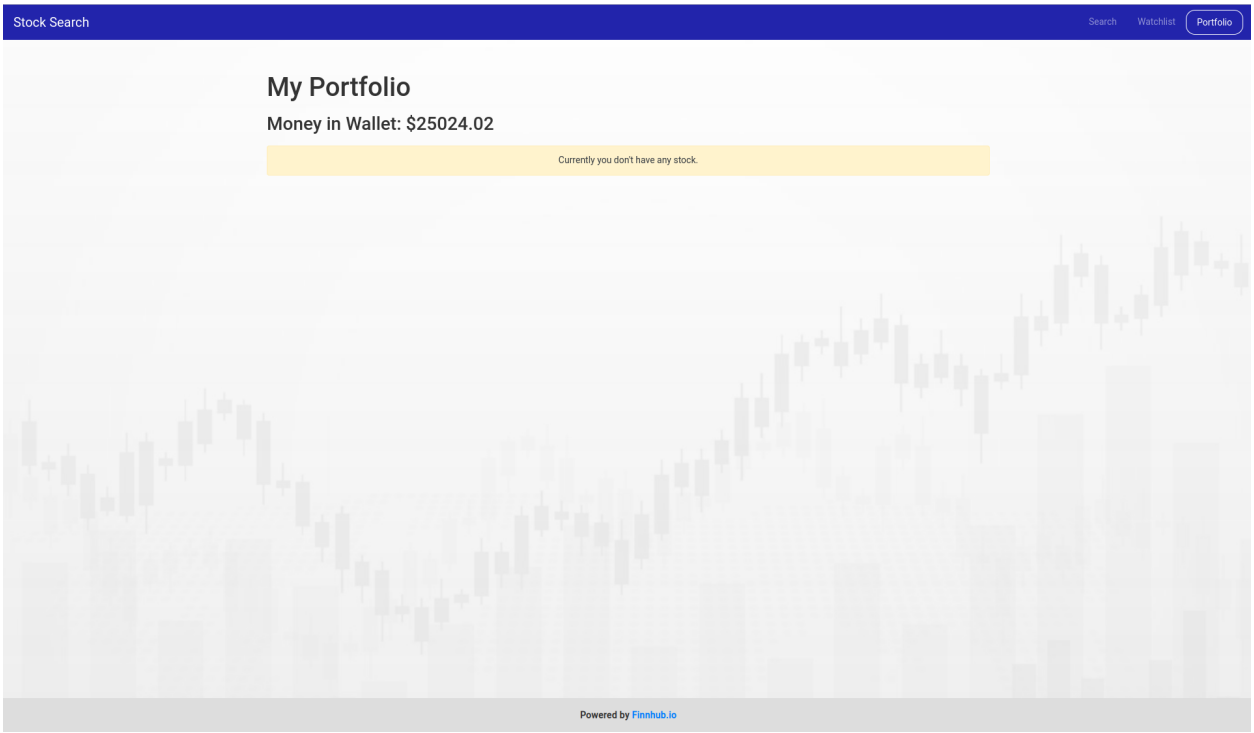


Figure 3.14: Portfolio Empty Alert

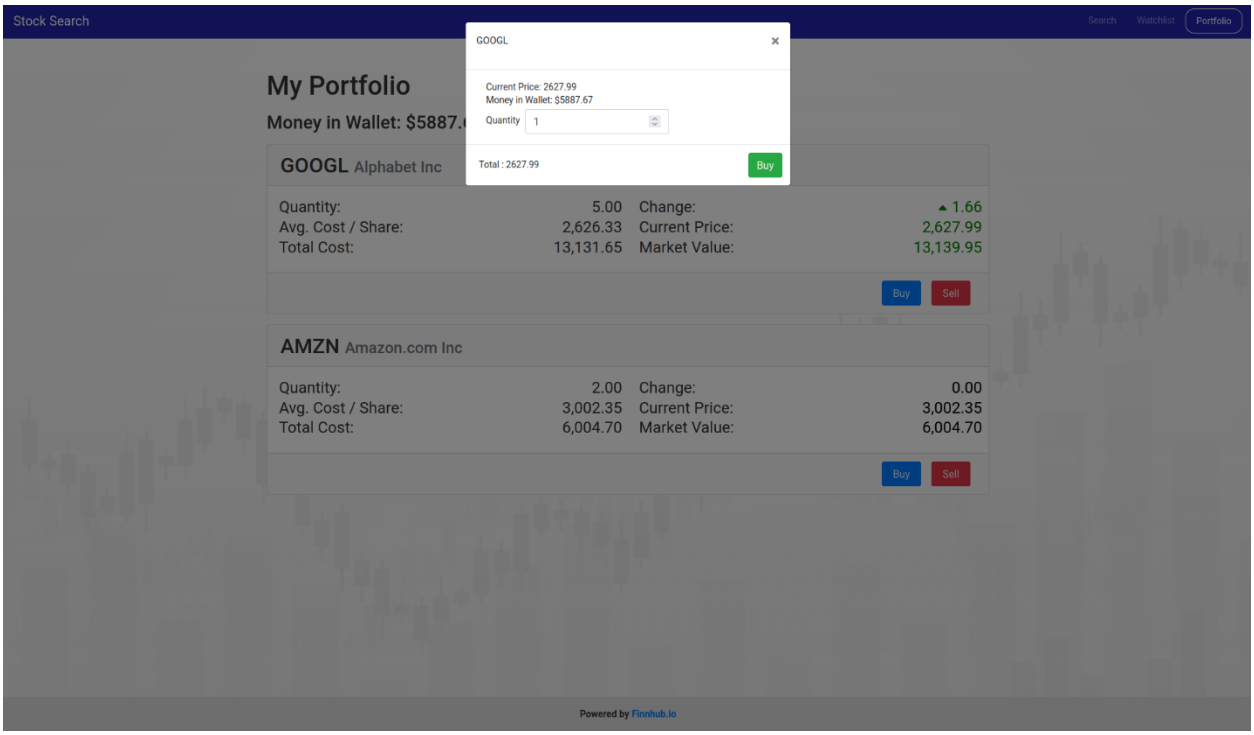


Figure 3.15: Modal for Buying Stock

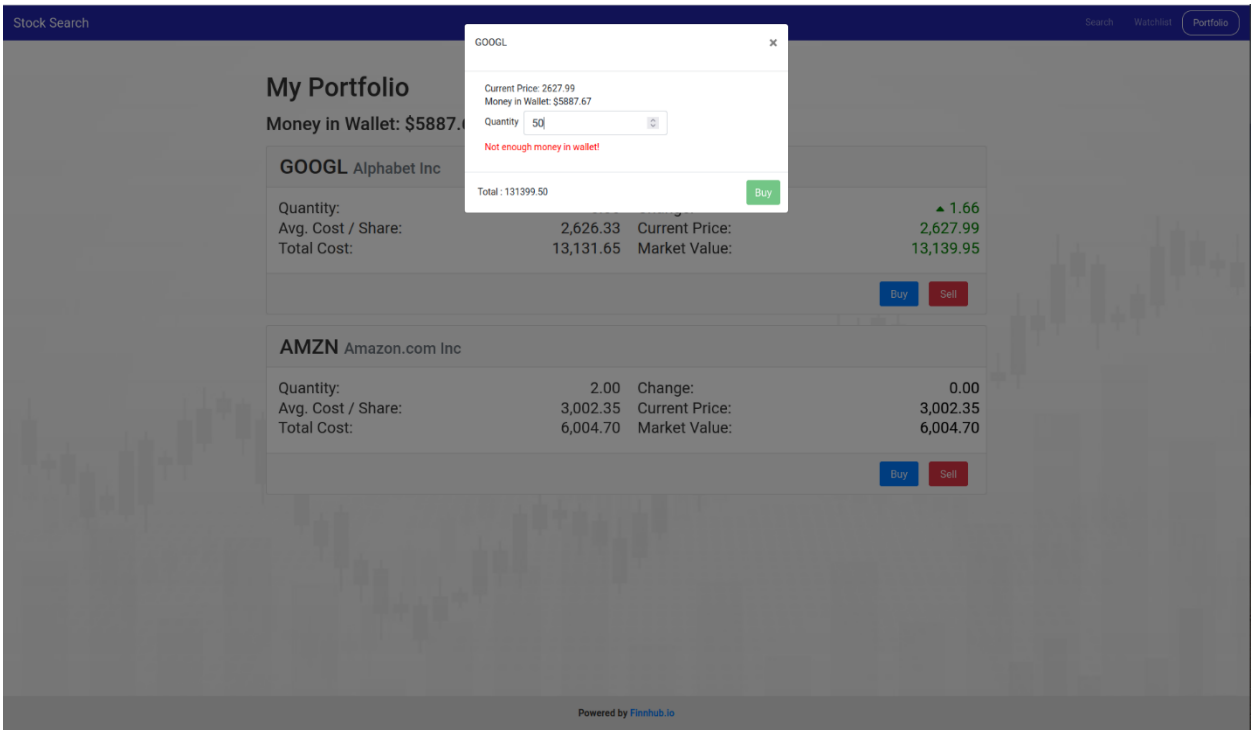


Figure 3.16: Input is invalid in Modal for Buying Stock

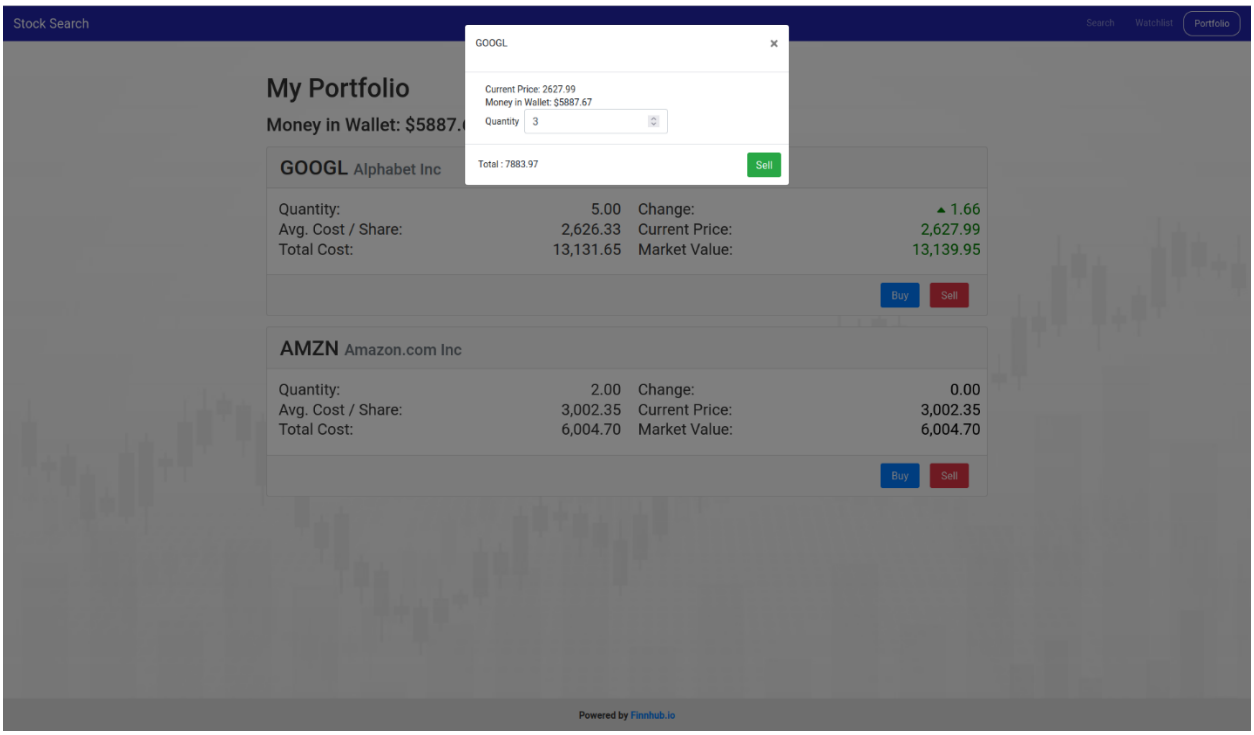


Figure 3.17: Modal for Selling Stock

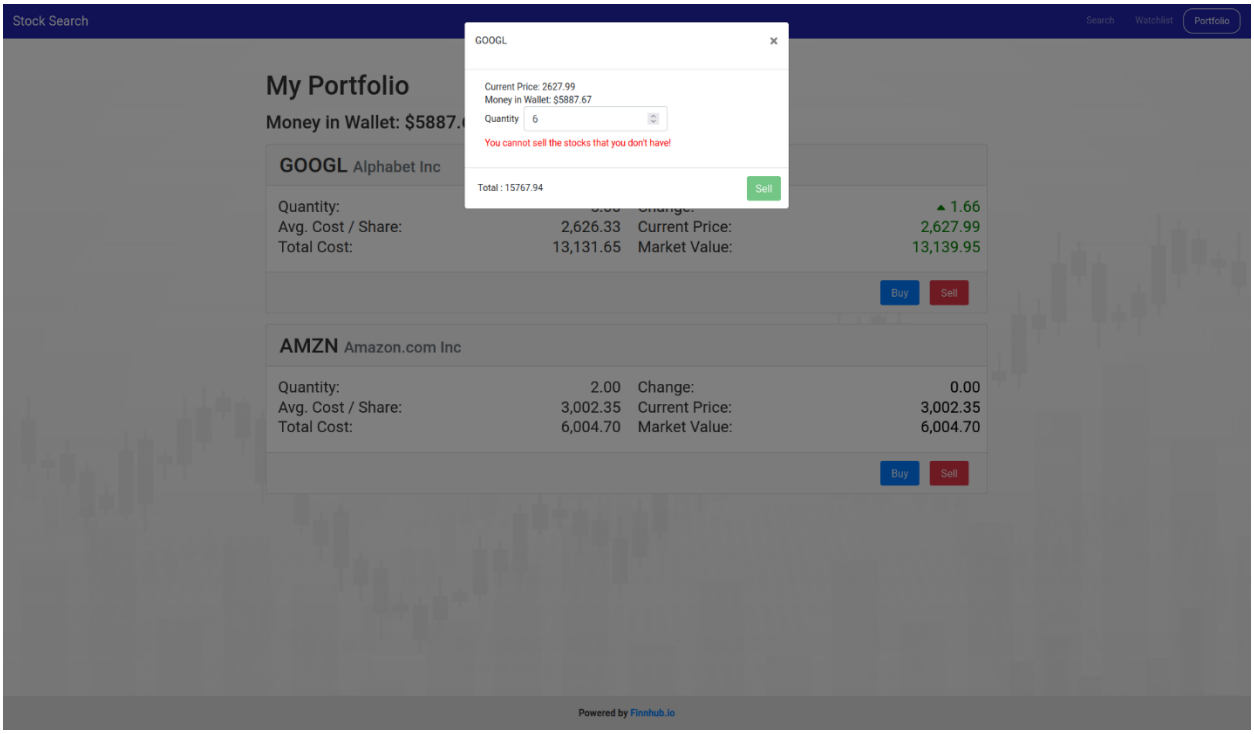


Figure 3.18: Input is invalid in Modal for Selling Stock

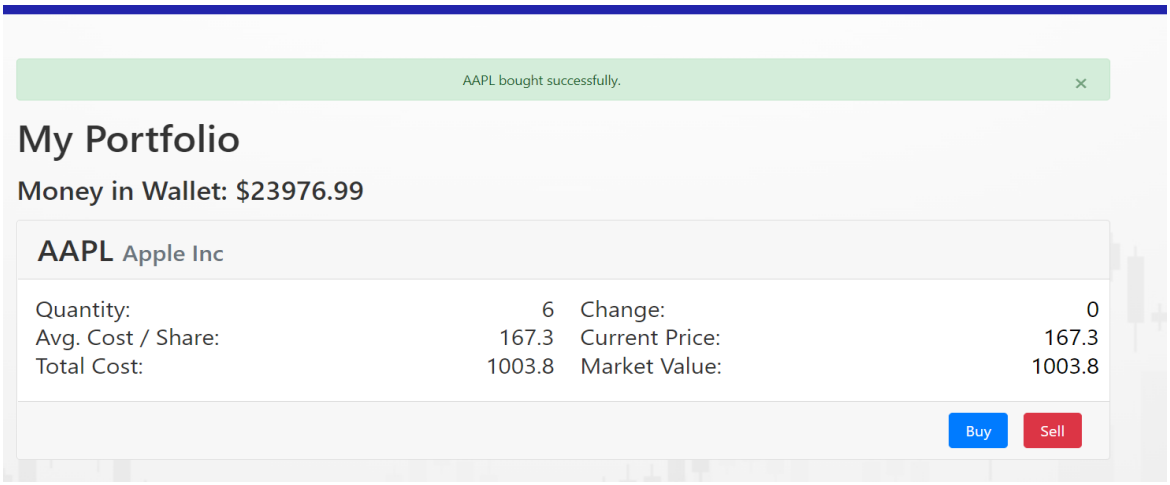


Figure 3.19: Auto closing alert message for buying more stocks from portfolio section

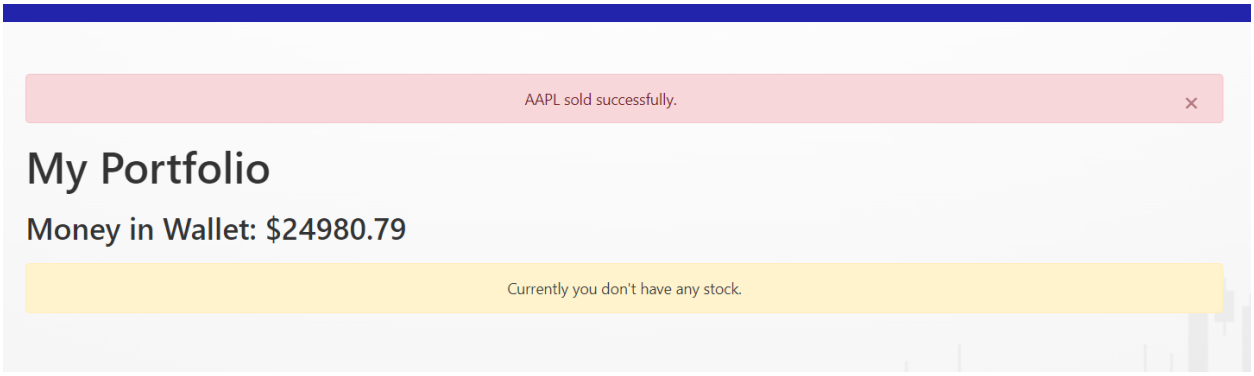
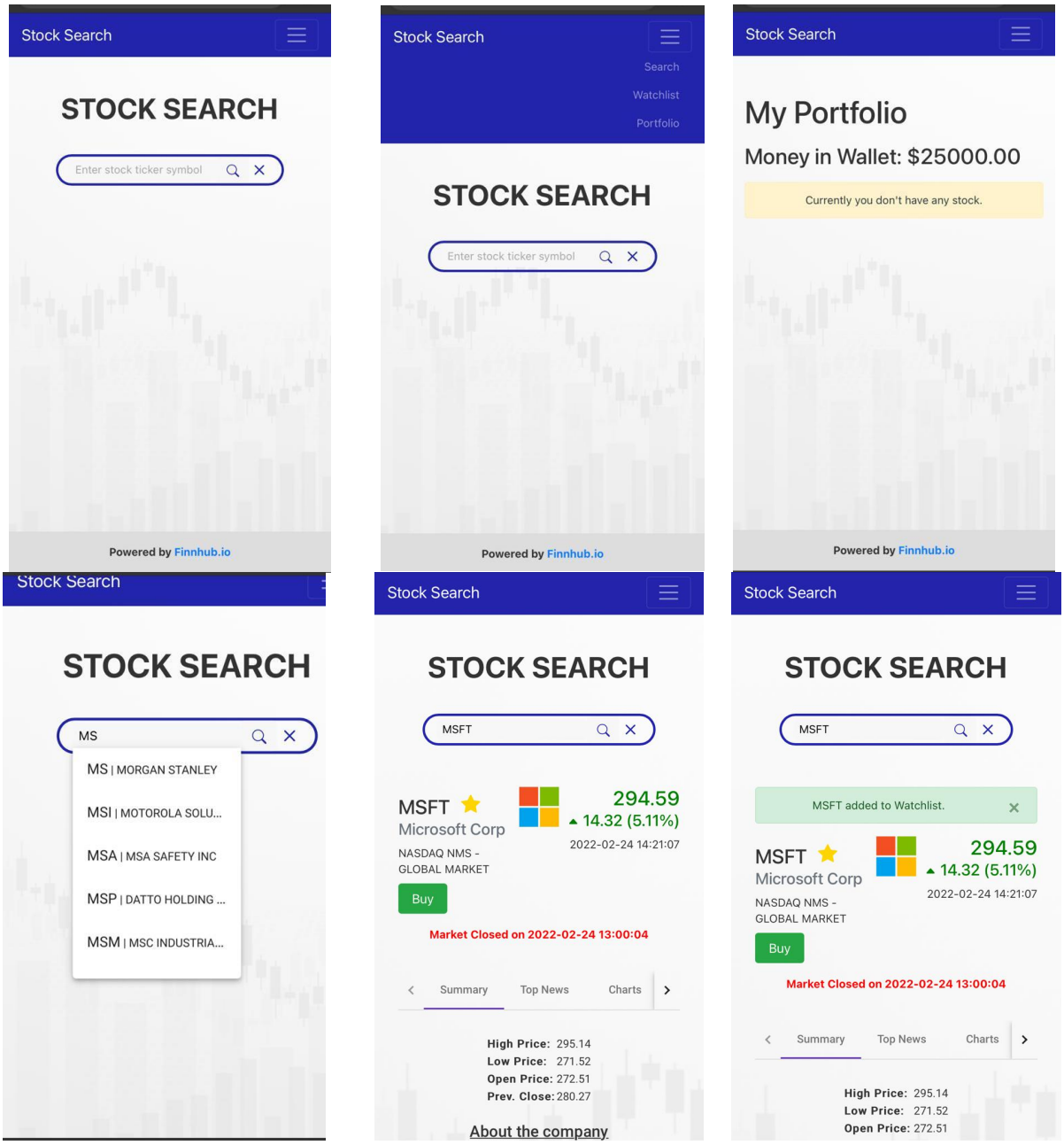
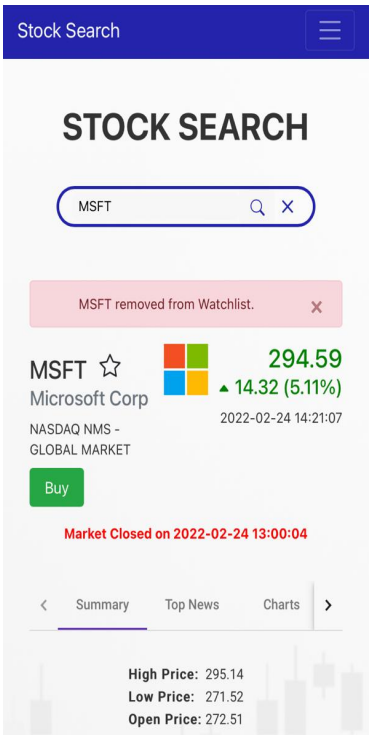


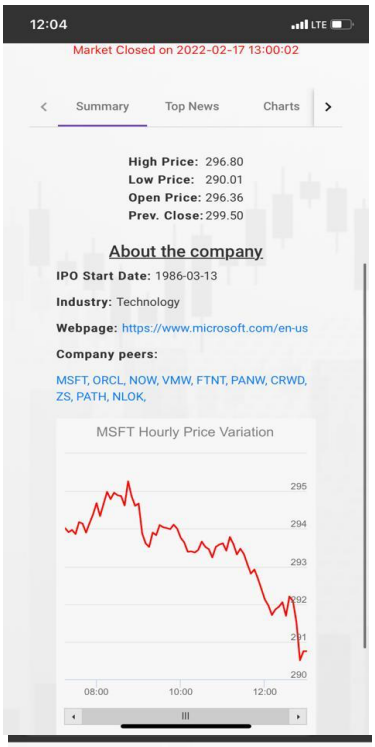
Figure 3.20: Auto closing alert message for selling stocks from portfolio section

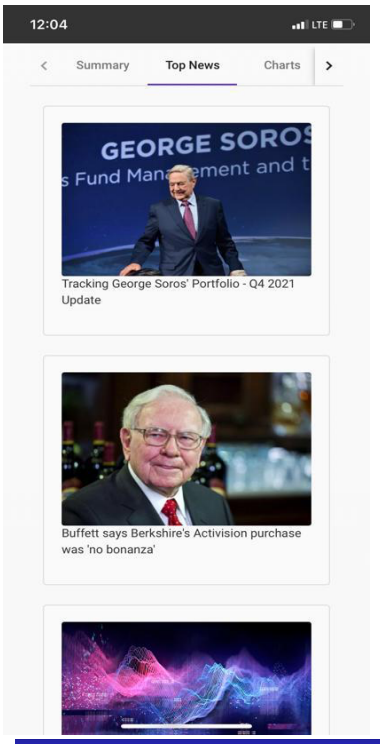
3.5 Responsive Design

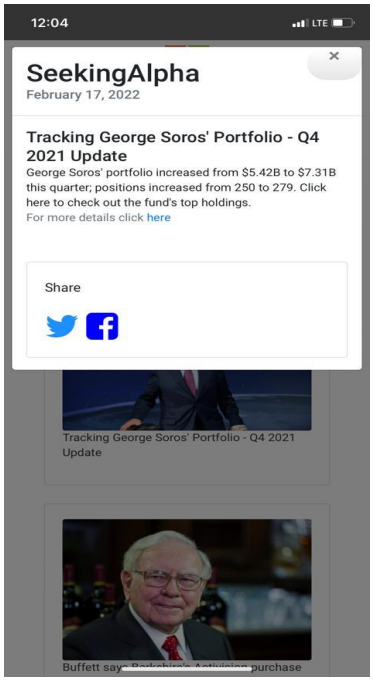
The following are a few snapshots of the web app opened with Google Chrome on a OnePlus mobile device.

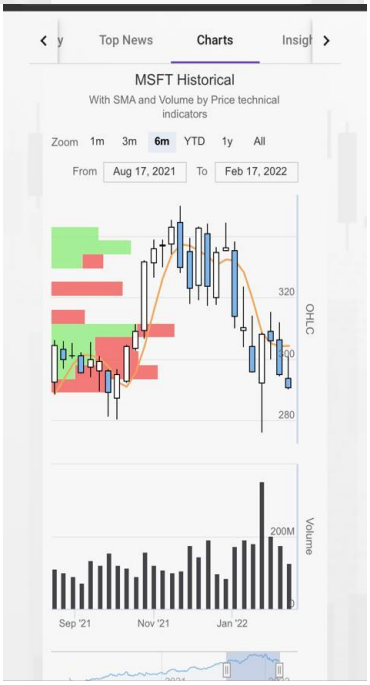


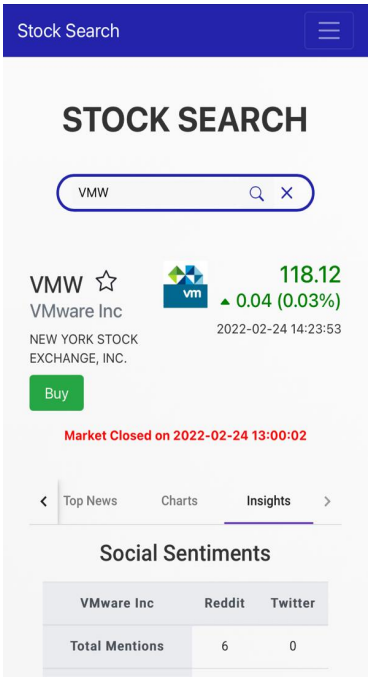

Stock Search
STOCK SEARCH
MSFT
MSFT removed from Watchlist.
MSFT
Microsoft Corp
NASDAQ NMS - GLOBAL MARKET
294.59
▲ 14.32 (5.11%)
2022-02-24 14:21:07
Buy
Market Closed on 2022-02-24 13:00:04
Summary
Top News
Charts
High Price: 295.14
Low Price: 271.52
Open Price: 272.51

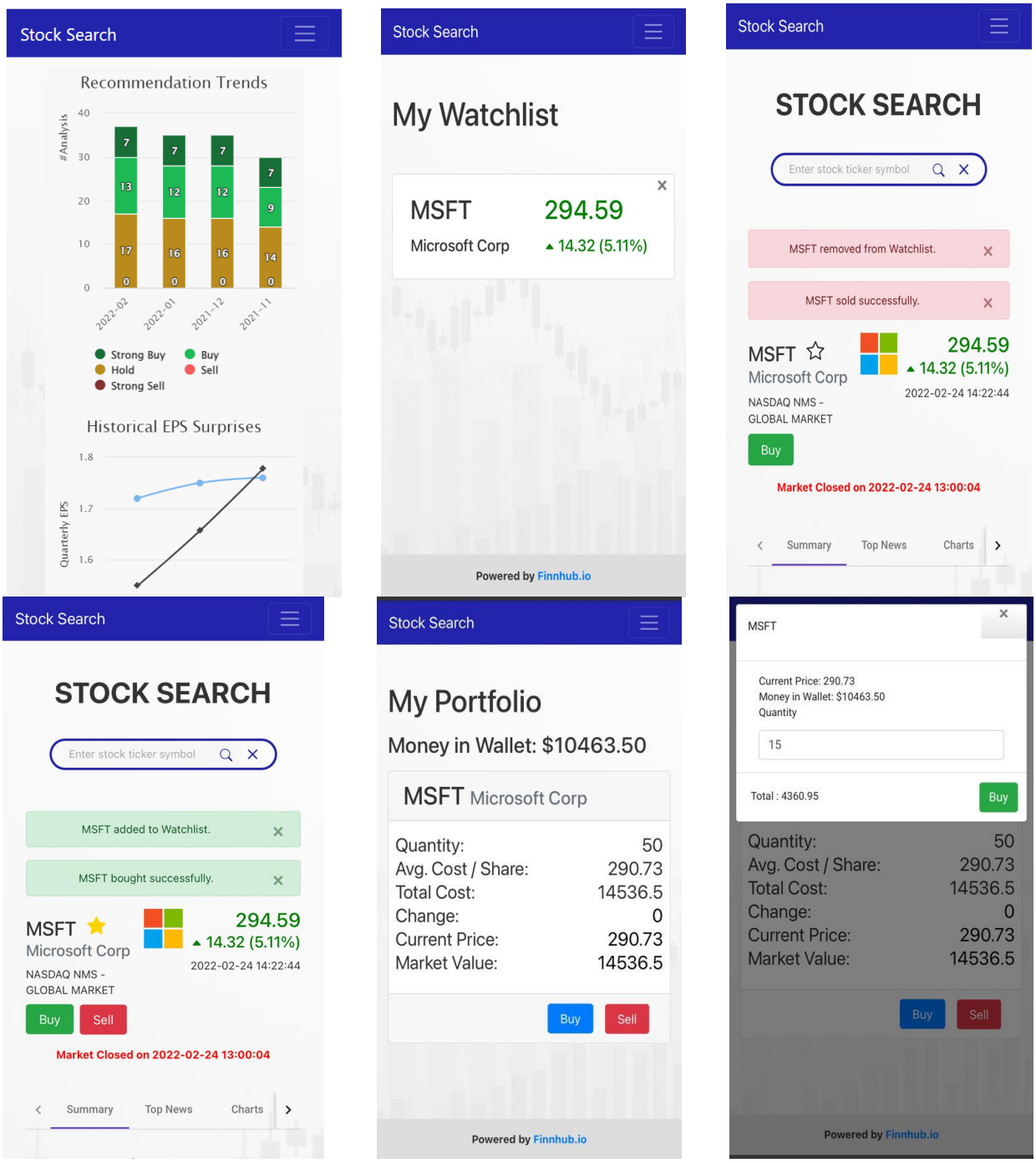

12:04
Market Closed on 2022-02-17 13:00:02
Summary
Top News
Charts
High Price: 296.80
Low Price: 290.01
Open Price: 296.36
Prev. Close: 299.50
About the company
IPO Start Date: 1986-03-13
Industry: Technology
Webpage: https://www.microsoft.com/en-us
Company peers:
MSFT, ORCL, NOW, VMW, FTNT, PANW, CRWD, ZS, PATH, NLOK,
MSFT Hourly Price Variation


12:04
Summary
Top News
Charts
Tracking George Soros' Portfolio - Q4 2021 Update
Buffett says Berkshire's Activision purchase was 'no bonanza'


12:04
SeekingAlpha
February 17, 2022
Tracking George Soros' Portfolio - Q4 2021 Update
George Soros' portfolio increased from $5.42B to $7.31B this quarter; positions increased from 250 to 279. Click here to check out the fund's top holdings.
For more details click here
Share
Tracking George Soros' Portfolio - Q4 2021 Update


Top News
Charts
MSFT Historical
With SMA and Volume by Price technical indicators
Zoom 1m 3m 6m YTD 1y All
From Aug 17, 2021 To Feb 17, 2022
OHLC
Volume
Sep '21
Nov '21
Jan '22


Stock Search
STOCK SEARCH
VMW
VMW
VMware Inc
NEW YORK STOCK EXCHANGE, INC.
118.12
▲ 0.04 (0.03%)
2022-02-24 14:23:53
Buy
Market Closed on 2022-02-24 13:00:02
Top News
Charts
Insights
Social Sentiments
VMware Inc
Reddit
Twitter
Total Mentions
6
0



You must watch the video carefully to see how the page looks like on mobile devices. All functions must work on mobile devices.

One easy way to test for mobile devices is to use Google Chrome Responsive Design Mode and Safari Develop – User Agent menu.

3.5 Navbar

The Navigation bar must be present on top of the page, and visible at all times, as shown in all the figures above. You can use Bootstrap to create a navbar. It consists of following menu options:

1. Search
2. Watchlist
3. Portfolio

3.6 Footer

The Footer must be present at the end of each page, as shown in above figures. It should contain following line:

"Powered by Finnhub.io"

4. API's description

4.1 Finnhub API calls, similar to Homework 6

In this homework, we will use the Finnhub API. A comprehensive reference about this API is available at:

https://finnhub.io/docs/api/introduction

4.1.1 Company's Description

Reference: https://finnhub.io/docs/api/company-profile2

For **Company's Description**, use the following API. For more details refer **Figure 4.1**:

https://finnhub.io/api/v1/stock/profile2?symbol=<TICKER>&token=<API_Key >

URL parameter in API Call:

- Ticker: Ticker symbol of the stock. E.g.: MSFT
- Token: The API access Token. It is private, please do not share with anyone. See Homework 6.

An example URL constructed from the parameters will look like this:

https://finnhub.io/api/v1/stock/profile2?symbol=AAPL&token=<API_Key >

Response:

Response Keys	**Details**
country	Country Name
currency	Currency Symbol
exchange	Company's Exchange

name	Company's Name
ticker	Company's Symbol
ipo	Company's Start Date
marketCapitalization	Company's MarketCap
shareOutstanding	Company's Shares
logo	Company's Logo
phone	Company's Contact No.
weburl	Company's Website Url
finnhubIndustry	Company's Industry

Table 4.1: Details regarding Company's Description API call


```
{
    "country": "US",
    "currency": "USD",
    "exchange": "NASDAQ NMS - GLOBAL MARKET",
    "finnhubIndustry": "Technology",
    "ipo": "1986-03-13",
    "logo": "https://finnhub.io/api/logo?symbol=MSFT",
    "marketCapitalization": 2245312,
    "name": "Microsoft Corp",
    "phone": "14258828080.0",
    "shareOutstanding": 7496.87,
    "ticker": "MSFT",
    "weburl": "https://www.microsoft.com/en-us"
}
```


Figure 4.1: Response received for Company's Description API call

4.1.2 Company's Historical Data

Reference: https://finnhub.io/docs/api/stock-candles

For **Company's Historical Data**, use the following API. For more details refer Figure 4.2:

> https://finnhub.io/api/v1/stock/candle?symbol=<TICKER>&resolution=<TIMEINTERVAL>&from=<UNIX_TIMESTAMP>&to=<UNIX_TIMESTAMP>1631627048&token=<API_KEY>

URL parameter in API Call:

- Ticker: Ticker symbol of the stock. E.g.: AAPL
- Token: The API access Token. It is private, please do not share with anyone.
- Resolution: Time interval for stock data. E.g.: 1,5,D,M etc.
- Timestamp: Time frame for stock data.

An example URL constructed from the parameters will look like this:

https://finnhub.io/api/v1/stock/candle?symbol=AAPL&resolution=1&from=1631022248&to=1631627048&token=<API_KEY>

Response:

Response Keys	Details
C	List of close prices for returned candles.
H	List of high prices for returned candles.
L	List of low prices for returned candles.
O	List of open prices for returned candles.
S	Status of the response. This field can either be ok or no_data.
T	List of timestamp for returned candles.
V	List of volume data for returned candles.

Table 4.2: Details regarding Company's Historical Data API call

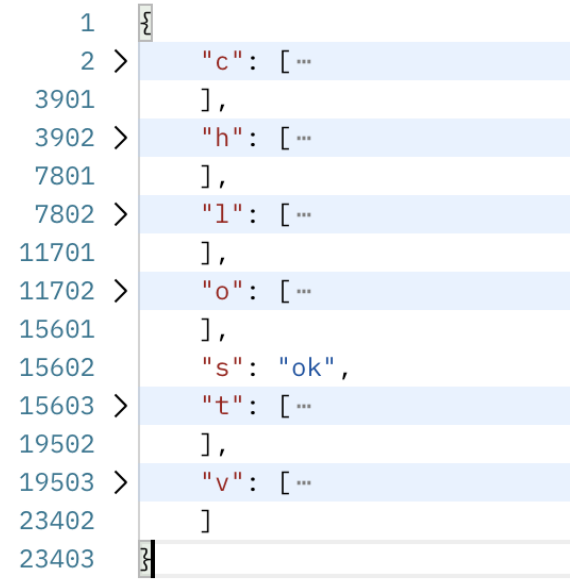


Figure 4.2: Response received for Company's Historical Data API call

4.1.3 Company's Latest Price of Stock:

Reference: https://finnhub.io/docs/api/quote

For **Company's Latest Price**, use the following API. For more details refer to **Figure 4.3**:

https://finnhub.io/api/v1/quote?symbol=<TICKER>&token=<API_KEY>

URL parameter in API Call:

- Ticker: Ticker symbol of the stock. E.g.: MSFT
- Token: The API access Token. It is private, please do not share with anyone.

An example URL constructed from the parameters will look similar to this:

https://finnhub.io/api/v1/quote?symbol=MSFT&token=<API_KEY>

Response: We receive an array of objects, where each object contains following keys. We only need the following keys from the response.

Response Keys	Details
c	current price
d	change in price
dp	percentage change in price
h	high price of the day.
l	low price of the day.
o	open price of the day.
pc	Previous close price
t	Timestamp of last stock data

Table 4.3: Details regarding Company's Latest Price API call.

Market Status must be open if the difference between current Timestamp (current Timestamp will be of the created using new Date() in javascript) and 'timestamp' key is less than 60 seconds.


```
{
    "c": 291.98,
    "d": -7.52,
    "dp": -2.5109,
    "h": 296.8,
    "l": 291.41,
    "o": 296.36,
    "pc": 299.5,
    "t": 1645130548
}
```


Figure 4.3: Response received for Company's Latest Price API call

4.1.4 Autocomplete:

Reference: https://finnhub.io/docs/api/symbol-search

For **Autocomplete**, use the following API. For more details refer Figure 4.4:

https://finnhub.io/api/v1/search?q=<QUERY>&token=<API_KEY>

URL parameter in API Call:

- Query: Search query of stock ticker . E.g.: TSL for TSLA
- Token: The API access Token. It is private, please do not share with anyone.

An example URL constructed from the parameters will look similar like:

https://finnhub.io/api/v1/search?q=AMZ&token=<API_KEY>

Response: We receive a response in the form of array of objects. From those objects we only need the following keys:

Response Keys	**Details**
count	number of results
result	array of search result
description	symbol description
displaySymbol	display symbol name
symbol	unique symbol used to identify this symbol used in /stock/candle endpoint.
type	security type

Table 4.4: Details regarding Autocomplete Response. API call


```
{
    "count": 34,
    "result": [
        {
            "description": "AZUCAR MINERALS LTD",
            "displaySymbol": "AMZ.V",
            "symbol": "AMZ.V",
            "type": "Common Stock"
        },
        {
            "description": "AZUCAR MINERALS LTD",
            "displaySymbol": "AMZ.NE",
            "symbol": "AMZ.NE",
            "type": "Common Stock"
        },
        {
            "description": "AMAZON.COM INC",
            "displaySymbol": "AMZ.MU",
            "symbol": "AMZ.MU",
            "type": "Common Stock"
        },
        {
            "description": "AMAZON.COM INC",
            "displaySymbol": "AMZ.DE",
            "symbol": "AMZ.DE",
            "type": "Common Stock"
        },
        {
            "description": "AMAZON.COM INC",
            "displaySymbol": "AMZ.HM",
            "symbol": "AMZ.HM",
            "type": "Common Stock"
        },
```


Figure 4.4: Response received for autocomplete API call

4.1.5 Company's News

Reference: https://finnhub.io/docs/api/company-news

For **Company's News**, use the following API. For more details refer **Figure 4.5**:

https://finnhub.io/api/v1/company-news?symbol=<TICKER>&from=<DATE>&to=<DATE>&token=<API_KEY>

URL parameter in API Call:

- Ticker: Ticker symbol of the stock. E.g.: MSFT
- to: Date in YYYY-MM-DD
- from: Date in YYYY-MM-DD
- Token: The API access Token. It is private, please do not share with anyone. See Homework 6.

An example URL constructed from the parameters will look similar to this:

https://finnhub.io/api/v1/company-news?symbol=MSFT&from=2021-09-01&to=2021-09-09&token=<API_KEY>

Response:

Response Keys	**Details**
category	News category
datetime	Published timestamp in UNIX
headline	News headline
id	News id
image	Thumbnail image URL
related	Related stocks and companies mentioned
source	News source
summary	News summary
url	url of original article

Table 4.5: Details regarding Company's News API call

```
[
    {
        "category": "company",
        "datetime": 1631221522,
        "headline": "Arrival Might Be Worth A Speculative Look Here",
        "id": 70429020,
        "image": "https://static.seekingalpha.com/cdn/s3/uploads/getty_images/1249145859/medium_image_1249145859.jpg",
        "related": "MSFT",
        "source": "SeekingAlpha",
        "summary": "Arrival moves closer to production, with more demos and test trials occurring as microfactories in Rock Hill and Bicester move closer towards completion.",
        "url": "https://finnhub.io/api/news?id=ac5479a596494cf4d13a62b1459f5dc391485c5872a3f3b9e85420a13cc4d4c4"
    },
    {
        "category": "company",
        "datetime": 1631220499,
        "headline": "Microsoft rolls out new features for its Teams app",
        "id": 70430582,
        "image": "https://s.yimg.com/ny/api/res/1.2/mU2NHnevt8nU6TUKFBSYPA--/YXBwaWQ9aGlnaGxhbmRlcjt3PTEyMDA7aD02NzU-/https://s.yimg.com/hd/cp-video-transcode/prod/2021-09/09/613a7314ddb40d0fba1baecd/613a7314ddb40d0fba1baece_o_U_v2.jpg",
        "related": "MSFT",
        "source": "Yahoo",
        "summary": "Jared Spataro, Microsoft CVP of Modern Work, joined Yahoo Finance Live to discuss the new Teams app features and his outlook for the future of hybrid work.",
        "url": "https://finnhub.io/api/news?id=284ce70b7cd2233edcc61a10c6cebb7e160f76834e8ff667482af75996a64b7d"
    },
```


Figure 4.5: Response received for Company's News API call

4.1.6 Company's Recommendation Trends

Reference: https://finnhub.io/docs/api/recommendation-trends

For **Company's Recommendation Trends**, use the following API. For more details refer **Figure 4.6**:

https://finnhub.io/api/v1/stock/recommendation?symbol=<TICKER>&token=<API_KEY>

URL parameter in API Call:

- Ticker: Ticker symbol of the stock. E.g.: MSFT
- Token: The API access Token. It is private, please do not share with anyone. See Homework 6.

An example URL constructed from the parameters will look similar to this:

https://finnhub.io/api/v1/stock/recommendation?symbol=MSFT&token=<API_KEY>

Response:

Response Keys	Details
Buy	Recommendation count of buy category
Hold	Recommendation count of hold category
period	Upate period
sell	Recommendation count of sell category
strongBuy	Recommendation count of strongbuy category
strongSell	Recommendation count of strongsell category
Symbol	Company symbol

Table 4.6: Details regarding Company's Recommendation API call

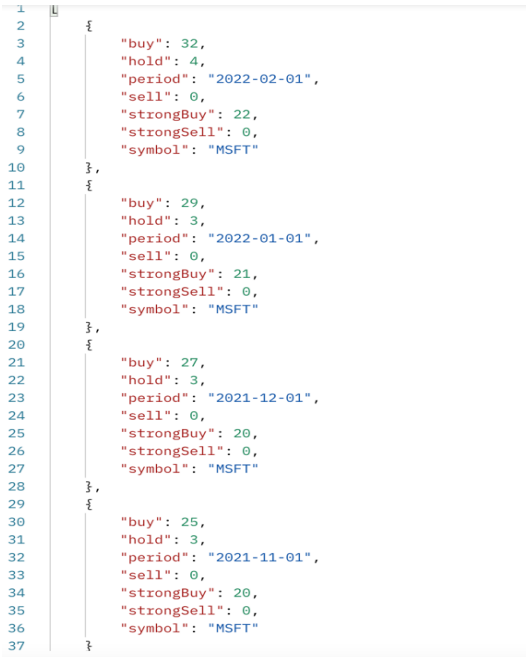


Figure 4.6: Response received for Company's Recommendation API call

4.1.7 Company's Social Sentiment

Reference: https://finnhub.io/docs/api/social-sentiment

For **Company's Social Sentiment**, use the following API. For more details refer **Figure 4.7**:

> https://finnhub.io/api/v1/stock/social-sentiment?symbol=<TICKER>&from=2022-01-01&token=<API_KEY>

NOTE: 'from=2022-01-01' should be used as a default parameter while using company's social sentiment API calls, if not used can sometime return empty response.

URL parameter in API Call:

- Ticker: Ticker symbol of the stock. E.g.: MSFT
- From: Date in YYYY-MM-DD (2022-01-01 to be used)
- Token: The API access Token. It is private, please do not share with anyone. See Homework 6.

An example URL constructed from the parameters will look similar to this:

> https://finnhub.io/api/v1/stock/social-sentiment?symbol=MSFT&token=<API_KEY>

Response:

Response Keys	Details
Reddit	Reddit sentiment
-atTime	period
-mention	Number of mentions
-negativeMention	Number of negative mentions
-negativeScore	Negative score. Range 0-1
-positiveMention	Number of positive mentions
-positiveScore	Positive score. Range 0-1
-score	Final score. Range -1 to 1
symbol	Company symbol
Twitter	Twitter sentiment
-atTime	period
-mention	Number of mentions
-negativeMention	Number of negative mentions
-negativeScore	Negative score. Range 0-1
-positiveMention	Number of positive mentions
-positiveScore	Positive score. Range 0-1
-score	Final score. Range -1 to 1

Table 4.7: Details regarding Company's Social Sentiment API call


```
{
    "reddit": [
        {
            "atTime": "2022-02-18 00:00:00",
            "mention": 3,
            "positiveScore": 0,
            "negativeScore": 0,
            "positiveMention": 0,
            "negativeMention": 0,
            "score": 0
        },
    "symbol": "MSFT",
    "twitter": [
        {
            "atTime": "2022-02-18 00:00:00",
            "mention": 10,
            "positiveScore": 0.62525,
            "negativeScore": -0.5926666666666667,
            "positiveMention": 4,
            "negativeMention": 3,
            "score": 0.6112857142857143
        },
```


Figure 4.7: Response received for Company's Social Sentiment API call

4.1.8 Company's Peers

Reference: https://finnhub.io/docs/api/company-peers

For **Company's Peers**, use the following API. For more details refer **Figure 4.8**:

https://finnhub.io/api/v1/stock/peers?symbol=<TICKER>&token=<API_KEY>

URL parameter in API Call:

- Ticker: Ticker symbol of the stock. E.g.: MSFT
- Token: The API access Token. It is private, please do not share with anyone. See Homework 6.

An example URL constructed from the parameters will look similar to this:

https://finnhub.io/api/v1/stock/peers?symbol=MSFT&token=<API_KEY>

Response:

Response Keys	Details
response	List of company symbols

Table 4.8: Details regarding Company's Peers API call


```
[
    "MSFT",
    "ORCL",
    "NOW",
    "VMW",
    "FTNT",
    "PANW",
    "CRWD",
    "ZS",
    "PATH",
    "NLOK"
]
```


Figure 4.8: Response received for Company's Peers API call

4.1.9 Company's Earnings

Reference: https://finnhub.io/docs/api/company-earnings

NOTE: If any of the response values are null values for response keys, replace null values to 0. Sample null response received from Finnhub API (Figure 4.9.1) which should be handled and replaced with 0.

For **Company's Earnings**, use the following API. For more details refer **Figure 4.9.1 and Figure 4.9.2**:

https://finnhub.io/api/v1/stock/earnings?symbol=<TICKER>&token=<API_KEY>

URL parameter in API Call:

- Ticker: Ticker symbol of the stock. E.g.: MSFT
- Token: The API access Token. It is private, please do not share with anyone. See Homework 6.

An example URL constructed from the parameters will look similar to this:

https://finnhub.io/api/v1/stock/earnings?symbol=MSFT&token=<API_KEY>

Response:

Response Keys	**Details**
Actual	Actual earnings results
Estimate	Estimated earnings
Period	Reported period
Symbol	Company symbol

Table 4.9: Details regarding Company's Earnings API call


```
[
    {
        "actual": null,
        "estimate": 2.7008,
        "period": "2023-06-30",
        "surprise": null,
        "surprisePercent": null,
        "symbol": "MSFT"
    },
    {
        "actual": null,
        "estimate": 2.5295,
        "period": "2023-03-31",
        "surprise": null,
        "surprisePercent": null,
        "symbol": "MSFT"
    },
    {
        "actual": null,
        "estimate": 2.4229,
        "period": "2022-12-31",
        "surprise": null,
        "surprisePercent": null,
        "symbol": "MSFT"
    },
    {
        "actual": null,
        "estimate": 2.2157,
        "period": "2022-09-30",
        "surprise": null,
        "surprisePercent": null,
        "symbol": "MSFT"
    }
]
```


Figure 4.9.1: Null Response received for Company's Earnings API call

```
[
    {
        "actual": 2.48,
        "estimate": 2.3564,
        "period": "2022-06-30",
        "surprise": 0.1236,
        "surprisePercent": 5.2453,
        "symbol": "MSFT"
    },
    {
        "actual": 2.27,
        "estimate": 2.1163,
        "period": "2022-03-31",
        "surprise": 0.1537,
        "surprisePercent": 7.2627,
        "symbol": "MSFT"
    },
    {
        "actual": 2.17,
        "estimate": 1.9543,
        "period": "2021-12-31",
        "surprise": 0.2157,
        "surprisePercent": 11.0372,
        "symbol": "MSFT"
    },
    {
        "actual": 1.95,
        "estimate": 1.8142,
        "period": "2021-09-30",
        "surprise": 0.1358,
        "surprisePercent": 7.4854,
        "symbol": "MSFT"
    }
]
```


Figure 4.9.2: Response received for Company's Earnings API call

4.2 Socials

4.2.1 Twitter

Refer the following link for details:
https://developer.twitter.com/en/docs/twitter-for-websites/tweet-button/overview

4.2.2 Facebook

Refer the following link for details:
https://developers.facebook.com/docs/plugins/share-button/

5. Implementation Hints

5.1 ng-bootstrap Library

To get started with the ng-bootstrap toolkit, please see:
https://ng-bootstrap.github.io/#/home

Modules helpful for implementation:

Alerts - https://ng-bootstrap.github.io/#/components/alert/examples
Modal - https://ng-bootstrap.github.io/#/components/modal/examples

5.2 Bootstrap UI Components

Bootstrap provides a complete mechanism to make Web pages responsive for different mobile devices. In this exercise, you will get hands-on experience with responsive design using the Bootstrap Grid System.

https://getbootstrap.com/docs/4.0/layout/grid/

Some components that are useful for implementation:

Bootstrap Cards https://getbootstrap.com/docs/4.0/components/card/
Bootstrap Navbar https://getbootstrap.com/docs/4.0/components/navbar/

5.3 Angular

- Angular Set up –
  https://angular.io/
- Angular Material Installation -
  https://material.angular.io/guide/getting-started
- Angular Material Tabs -
  https://material.angular.io/components/tabs/overview
- Angular Material Spinner –
  https://material.angular.io/components/progress-spinner/overview
- Angular Material Autocomplete -
  https://material.angular.io/components/autocomplete/overview
- Angular Routing –
  https://angular.io/guide/routing-overview

5.4 Local Storage

Refer the following documentation for detailed understanding on Local Storage and how to use it.

https://developer.mozilla.org/en-US/docs/Web/API/Window/localStorage

5.5 highcharts-angular

Refer the following documentation on **highcharts-angular** and how to use it.
https://www.npmjs.com/package/highcharts-angular

https://www.tutorialspoint.com/angular_highcharts/angular_highcharts_quick_guide.htm

https://github.com/highcharts/highcharts-angular

Chart type references:
https://www.highcharts.com/docs/chart-and-series-types/column-chart#stacked-column-chart

https://www.highcharts.com/docs/chart-and-series-types/spline-chart

https://www.highcharts.com/demo/stock/sma-volume-by-price

5.6 Icons

Reference: https://fontawesome.com/search

- https://icons.getbootstrap.com/icons/caret-up-fill/
- https://icons.getbootstrap.com/icons/caret-down-fill/
- https://icons.getbootstrap.com/icons/star/
- https://icons.getbootstrap.com/icons/star-fill/
- https://icons.getbootstrap.com/icons/x/
- https://fontawesome.com/icons/facebook-square?s=brands
- https://fontawesome.com/icons/twitter?s=brands

5.6 Deploy Node.js application on Cloud Services

Since Homework #8 is implemented with Node.js on Cloud Services, you should **select Nginx as your proxy server (if available)**, which should be the default option.

6. Files to Submit

In your course homework page, you should update the **Homework #8 link** to refer to your new initial web page for this exercise. Your files must be hosted on GCP, AWS or Azure cloud

services. Graders will verify that this link is indeed pointing to one of the cloud services. Additionally, you need to provide **an additional link** to the URL of the cloud service where the AJAX call is made with sample parameter values.

Also, submit your source code file to DEN D2L. Submit a ZIP file of both front-end and back-end code, plus any additional files needed to build your app. **The timestamp of the ZIP file will be used to verify if you used any "grace days."**

****IMPORTANT****:

- All discussions and explanations in Piazza related to this homework are part of the homework description and grading guidelines. So please review all Piazza threads, before finishing the assignment. If there is a conflict between Piazza and this description and/or the grading guidelines, **Piazza always rules**.
- You **should not call any of the APIs directly from JavaScript**, bypassing the NodeJS proxy. Implementing any one of them in "client" JavaScript instead of NodeJS will result in a **4-point penalty.**
- **APPEARANCE OF ALL VIEWS, TABLES AND CHARTS should be similar to the reference video as much as possible.**