

DATA EXPLORATION & VISUALISATION

# STOCK MARKET VISUALISATION PROJECT

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## INTRODUCTION

This visualisation project is an overview of the New York Stock Exchange and the S&P 500. The stock market has been the hot commodity for decades and it is still one of the busiest industries in the world. The clock here literally ticks by the seconds and it is all about the adrenaline rush day in and day out. One day you can win small the next day lose big. There are no guarantees but people still love taking this risk as it provides one of the highest returns. A little statistic about stocks vs other commodities or investment options.



**Fig1: Investment commodities comparison**

I want this project to be a kind of a “Stock Market 101”. Just to understand what it is, what are the elements of it, a bit of historical trend. It is very important to note the geographical aspect. Where is the zone for most of these companies that are listed on the NYSE? I am sure everyone has heard of Wall Street before.

In this project, I have taken the data from two data sources, the NYSE and S&P500. This data is panned from Jan 2010 to Feb 2018. This data shows us open, low, high, close for each day. For most of the graphs, we have considered the close price solely. This helps us get the trend for what the market closed at each day. The opening price can be higher or lower to the previous day's close price.

My audience for this project is anyone who wants a basic knowledge of the stock market, someone who wants historical trends or even someone who wants to make a financial investment in the stock market. I want my audience to have a neutral viewing and want them to get some meaning out of this visualisation project. This project has a lot of scopes to grow and can have real-time application as well. Currently, we can learn about the historical data for all the listed companies.

## DESIGN

The design approach used for this project is called the *Five Design Sheet Methodology*. It is an immersive and iterative way of creating a visual design for an app. The 5 design sheet methodology allows the designer to unbiasedly think about all the ideas and narrow them down to bring the best way to bring a good looking well-featured app. This method contains 5 sheets as follows:

1. [Brainstorming or Ideas Sheet](#)
2. [Initial Design 1](#)
3. [Initial Design 2](#)
4. [Initial Design 3](#)
5. [Final Design & Realisation](#)

Let us now discuss the design sheets for this app. The Five Design Sheets are attached in the [Appendix](#) at the end of this report.

### Ideas Sheet: [Sheet 1](#)

In this sheet, I put down all my ideas for the stock market data. I just drew or listed these ideas down. I had close to 15 ideas or visualisations that I could put into the design ranging from the traditional stock market ticker, the line graph to a dendrogram, world map etc. Below is a list of all the ideas on the list.

Stock market ticker	Companies Dropdown	Collapsible Tree
Dendrogram	World Map	Rotating Globe
Line Graph	Area chart	Stacked Area Map
Streamgraph	Horizon Chart	Bar Chart
Doughnut Chart	Network Graph	Stacked Bar Chart

I labelled these different visualisation ideas by numbers. The next task for me was to Filter these ideas. I filtered these ideas based on the necessity. The features of this visualisation project were put into two aspects – “Need to have” and “Good to have”.

Based on the above filter of ideas, I combined various ideas to make some logical sense. This led me to combine ideas that gave more meaning together. I tried to refine these ideas on a more theme-based grouping. This helped me to create three groups from three perspectives. One perspective of keeping the traditional stock market visualisations in mind. The next of a geographical aspect and detailed understanding of various companies and their lineage. Their sectors and subsectors as given by the United States Securities and Exchange Commission, better known as the SEC. The third approach was to create detailed visualisations based on statistical graphs.

These three approaches helped in creating the initial designs based on each of the above approaches. Each approach pushing to think from a different perspective and create the best possible visualisation app.

## Initial Design 1: [Sheet 2](#)

The approach for this design is with keeping the stock markets traditional dashboard in mind.

This design begins with a stock market style ticker on top of the page. This ticker would have the current stock market data on a daily basis and it would say if it has increased from the previous day or decreased. This would also include the percentage difference since yesterday, positive or negative.

The next visualisation on this page was a collapsible search tree with a dropdown to select the company about which you want to search the details. The colour for different levels of the tree will be different. And every time you search for a company it would highlight the path from the source to the company. This graph would help us understand the structure of the companies and their domains and specialities.

The next graph is a stream graph for a few pre-chosen companies. This graph would show the data over the years to create a stream effect. The colours would depict each company.

Lastly, a line graph with x-axis as months of the year and y-axis as the price with colours based on the years for each company. These four graphs were very traditional and would provide a lot of meaning.

This idea had good potential with someone who understood the graphs. But my goal was to make it easy for beginners too. Hence, so much information may not provide the required meaning to someone who may not understand the visualisation.

## Initial Design 2: [Sheet 3](#)

This design had an approach from a geographical perspective and understanding the stock market structure.

This design had a lovely colourful network chart with each level of the network having different colours for each level and making a radial network. This design was inspired by the force directed graph in D3.

Following the network graph, I have a world map with a density of companies across the globe. This world map would be controlled by 4 dropdowns for sectors, subsectors, company names and percentage increase across the years. These filters would help navigate around the globe. This design was smaller than the first one.

The good part was that the globe with drop down is that it is very detailed but could be complicated to implement.

### Initial Design 3: [Sheet 4](#)

This sheet is inspired by statistical graphs. This sheet hence contains bar charts, line graphs, area chart and stream graph.

The area chart would be ideal to show the historical data in a yearly format. The stream graph would show accumulated data by sectors or subsectors. The Bar chart shows the design of each year grouped by may be sector or companies. This would be a grouped bar chart. The line graph would be on a daily scale again the colour defined by either company or sectors. It is very common to see such a graph in the stock market world.

This design was too high level for a basic user as they may not understand the need for a particular visualisation. But the amount of information conveyed in this one may be very useful to an analyst or a trader who works in this domain every day.

### Realisation & Final Design: [Sheet 5](#)

The final design is inspired by all the three approaches coming together and creating a modern yet simple and a little minimalistic design which gives an intuitive and immersive experience. The design of the main page is created by keeping in mind the pros and cons of the three initial designs.

This design begins with a stock market style ticker on top of the page. This ticker would have the current stock market data on a daily basis and it would say if it has increased from the previous day or decreased. This would also include the percentage difference since yesterday, positive or negative.

This is followed by a collapsible search tree with a dropdown to select the company about which you want to search the details. The colour for different levels of the tree will be different. And every time you search for a company it would highlight the path from the source to the company. This graph would help us understand the structure of the companies and their domains and concentrations.

The next visualisation is a globe with a density of the company locations. That is it would show where there are more companies on the map that are listed on the NYSE. This data was acquired by web scraping for the location of each city's geo details as Google Maps API is no more public.

The last part to this is a continually changing graph consisting of various mixed graphs like area, line, bar, stream, etc. changing amongst each other to create an interesting animation to engage and amuse the user.

This realisation was well achieved and helped in understanding the better implementation of the required design for this project.

## IMPLEMENTATION

The following are the different aspects of my implementation of this project. Let us start by going through the technical details.

### System Environment

This project was developed and tested in the following environment:

- Operating System: Windows 10 Home
- RAM: 8GB
- Processor: Intel Core i7
- IDE: Brackets
- Browser: Google Chrome
- Internet: Wireless NBN

### Technology

- HTML5/CSS3 – for webpage design
- Javascript – for scripting and implementing D3
- Data-Driven Documents (D3) JS Library – To use the data to create visualisations
- Python – for wrangling, modifying and reshaping the data to fit the design needs
- Data format – Comma Separated Values(CSV), JavaScript Object Notation (JSON)

### Justification

The current design of the project is very similar to the final design sheet except for the elements are rearranged for a better experience. I decided to implement this project using JavaScript's D3 library as this library provided me with the creative freedom to explore non-traditional visualisation methods and implementing a modern looking web page.

This also meant writing javascript to create every graph but it also allowed me the liberty to have dependencies on other javascript libraries and also improve my understanding of D3. I have recognised D3 to be a powerful design tool which is underrated. It could be because it is very code intensive and does not have many supporting libraries. A simple graph code in R could be of one to five lines for example and the same code in D3 can run into fifty plus lines. This increases the workload and made my implementation even lengthier.

The implementation took almost 3 weeks worth of time including initial design and research on the required methodologies to complete this project.

## USER GUIDE

Instructions for viewing and exploring the narrative visualisation using a standard web browser and images showing how the visualization works.

## Application Package

The following is the list of files required to run this code successfully.

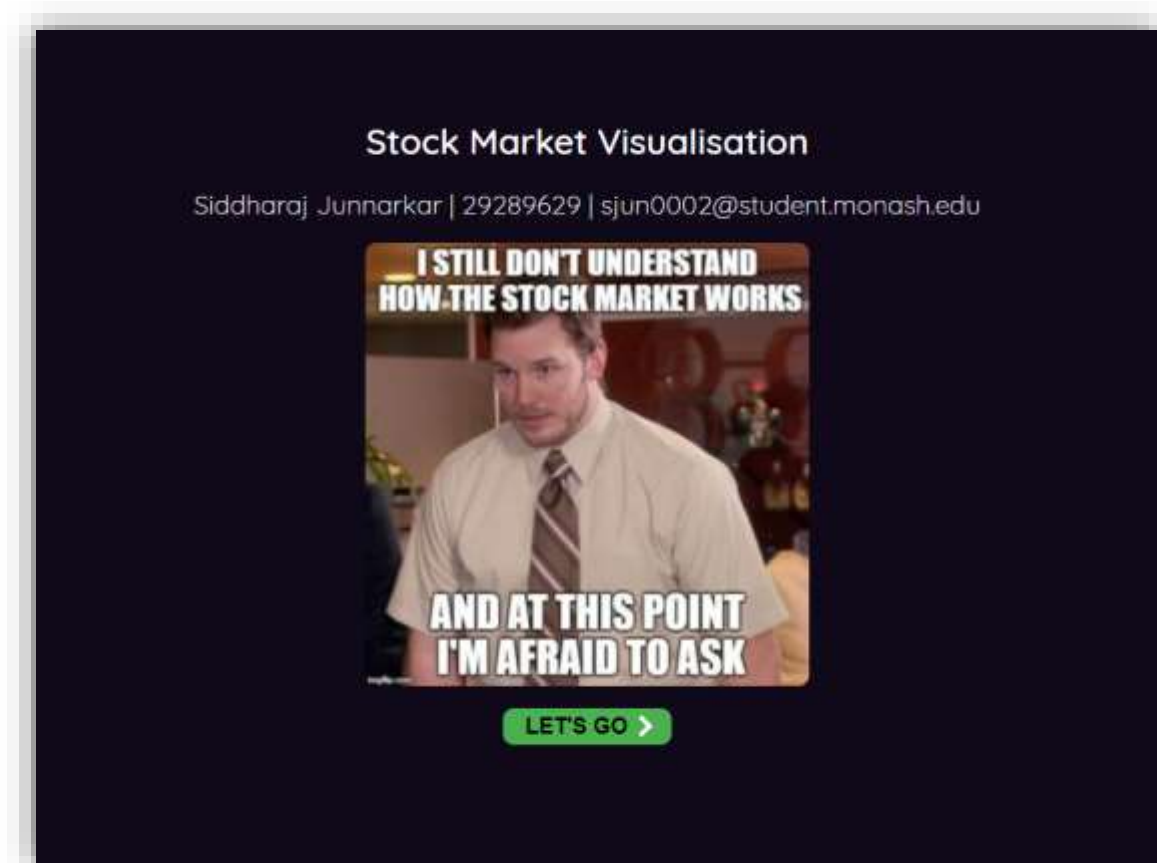
index.html	style.css	dataset.csv
globe.html	globe.js	locations.json
search_tree.html	search_tree.js	search_tree.json
lines.html	lines.js	lines.csv
multi_graph.html	multi_graph.js	multi_graph.csv
world-110m.json	Image.jpg	

*\*All the above-mentioned files are in the submitted package and these need to be in the same folder and the BRACKETS or python HTML server running to successfully run these files.*

*Please use Brackets to run the code. Else, the loading time will be much higher.*

## Landing Page

On running **index.html**, you will see the below screen. Click on the “**Let’s Go**” Button.



**Fig 2: Landing page screenshot**



## Main Screen & Rotating Globe

On Clicking “Let’s Go” you will be taken to the main screen which looks as below:



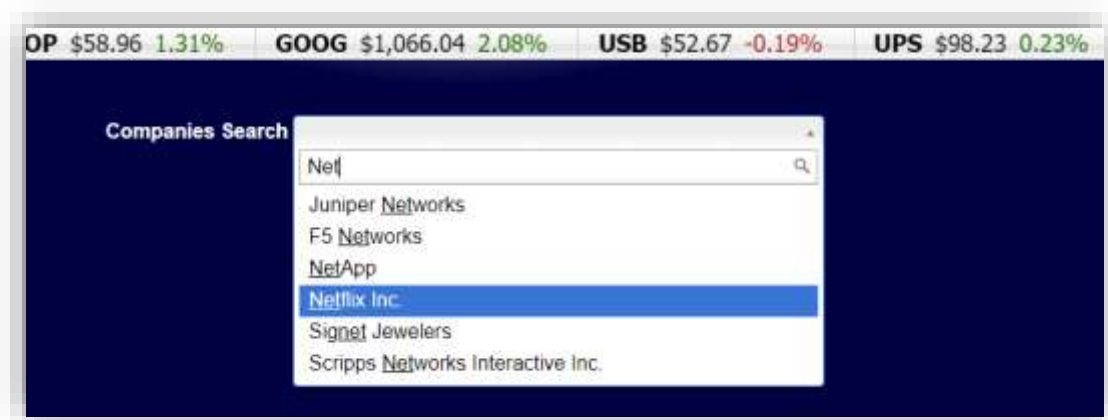
**Fig 3: Main screen and Rotating Globe Visualisation**

There are three things to observe on this page:-

- The Stock Market ticker on top of the page – *Please Note* This ticker is from the live data of the stock market and it is not a visualisation created in D3.
- The Title and My details in the subtitle
- The rotating globe with location density of the companies. *Please Note* There are no interactions on this visualisation.

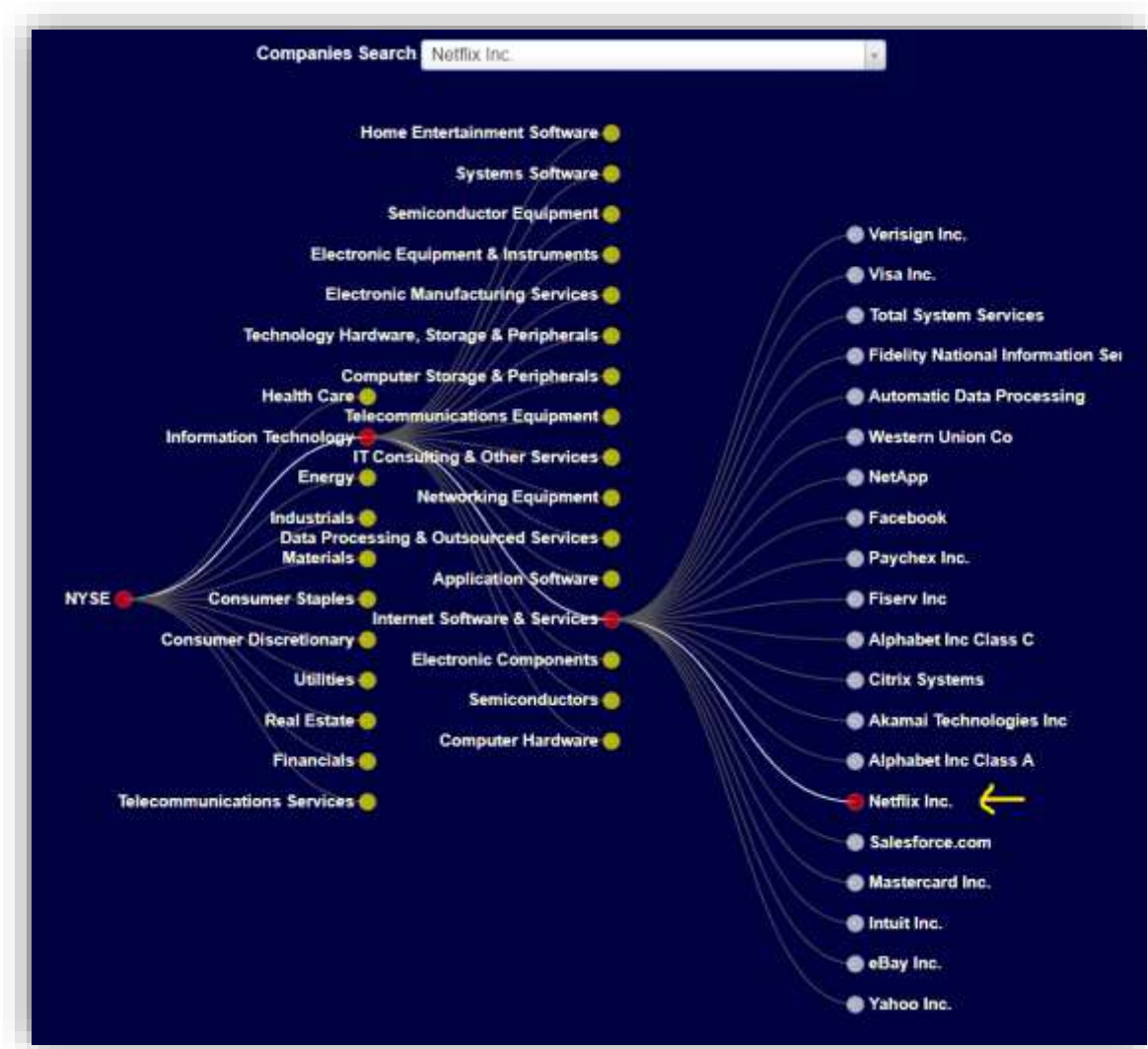
## Search Collapsible Tree

On **Scrolling Down**, you will see an empty screen with a searchable dropdown.



**Fig 4: Search for a company in the dropdown**

As you select a company from the dropdown you will see a tree appears and shows you the path to your company.



**Fig 5: A collapsible tree with Sectors Subsectors and Companies**

In this visualisation, you can search from the dropdown and then you can click on a node to Collapse it. Clicking on a node to open the node may not work based on the browser. This Graph may take a lot of time to load if not loaded in the live preview of Brackets.

## Line Graph

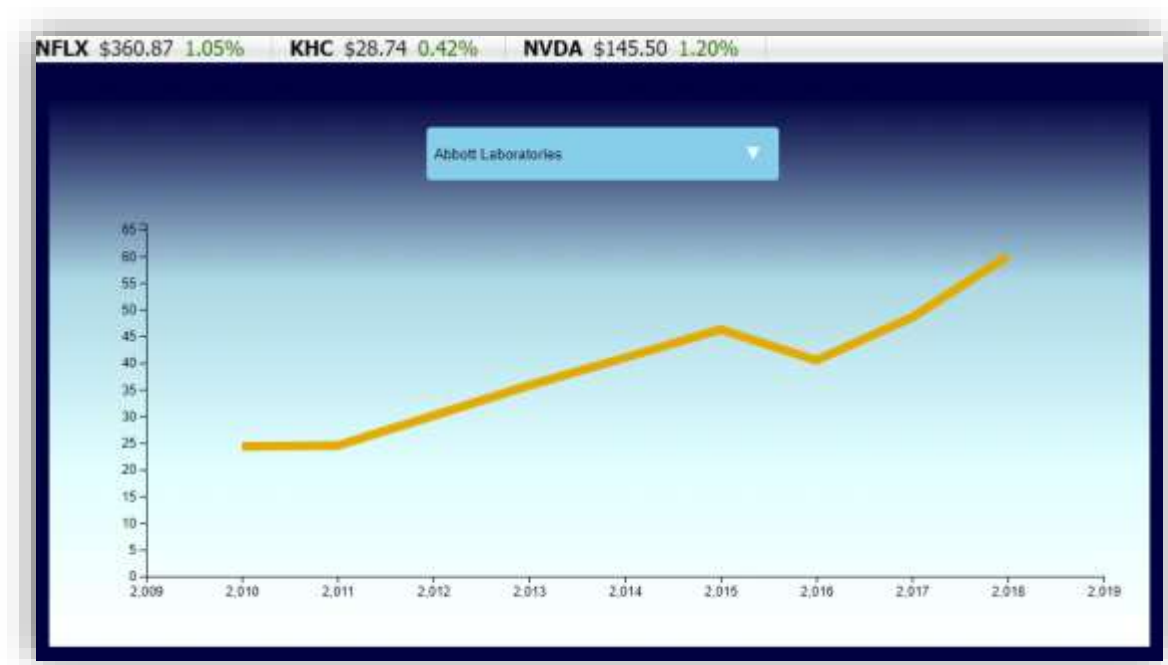
On scrolling further down you will see a line graph for each company in the dropdown. On selecting the dropdown the graph changes with y domain changing

Have a look at this screenshot:



**Fig 6: Dropdown of companies for line graph**

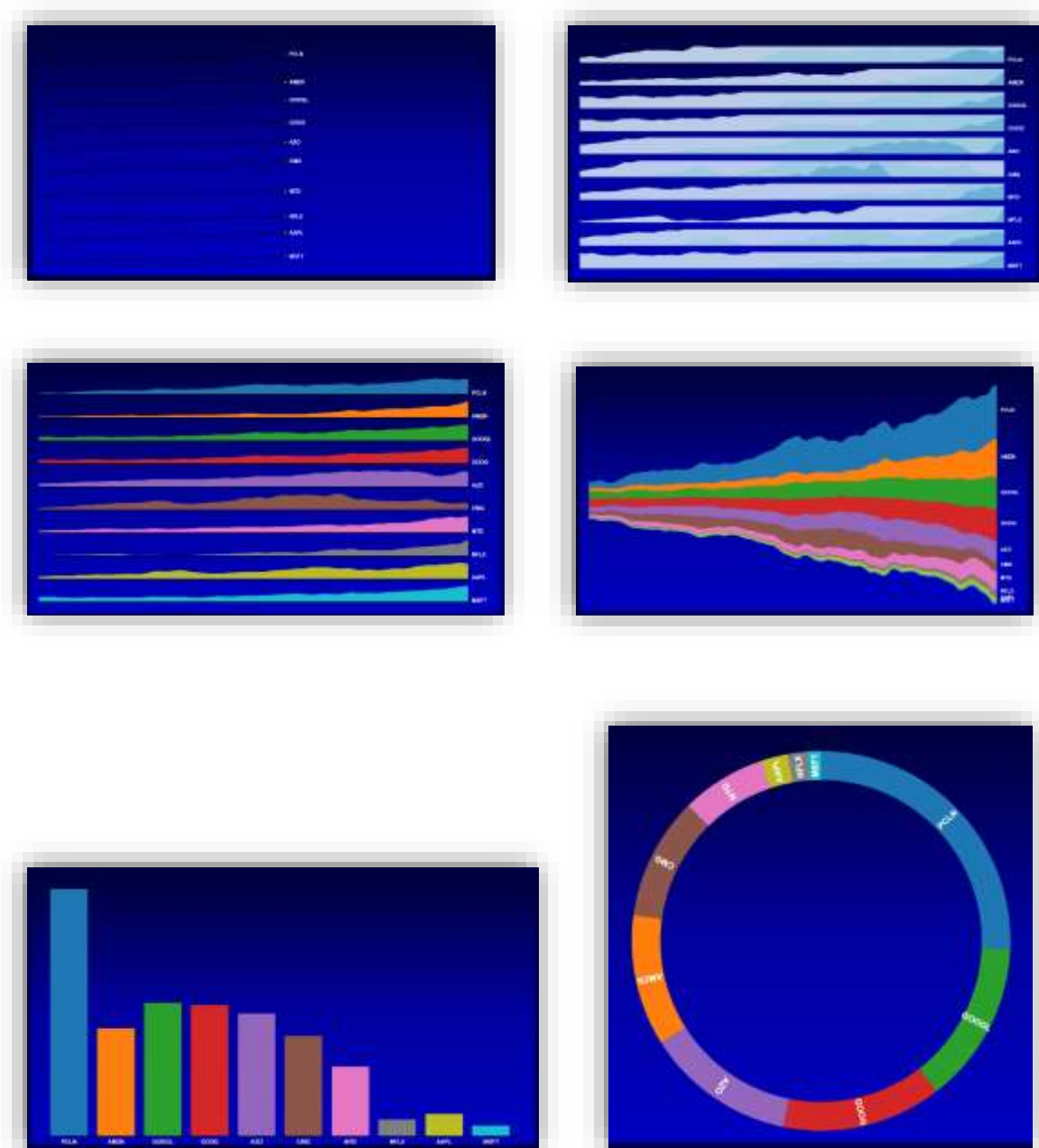
On Selecting as above you will see the graph as below. Play with it multiple times to get a feel. In this list, companies who have started after 2010 are not included. Hence companies like Facebook and few others are unavailable.



**Fig 7: Line graph**

## Multi-Graph Animation

This is the last visualisation on the page. This is a carousel of various graphs that are animated to transform from one to the other. Below screenshots are a few glimpses.



***Fig 7: Multi graph animation showing some of the different phases***

## CONCLUSION

This Project had a lot of learning. Especially learning how to use D3 to make meaningful graphs. This project definitely helped sharpen my D3 skills. I am more confident now to approach a visualisation assignment in the real world and because this being such an open-ended assignment, helped me explore my own skills.

Talking about the stock market, this project helped me understand why there is so much rush in traders about the stock market because it is such a highly scalable and real-time application of analytics and visualisation.

There is a lot to take back from this project apart from domain knowledge, I learnt new things about my creativity and thinking. I am sure this will help me out there in the real world.

## REFERENCES

- Area Chart. (2019). Retrieved from <https://observablehq.com/@d3/area-chart?collection=@d3/d3-shape>
- Bright, P. (2019). d3 rescale axis example. Retrieved from <http://bl.ocks.org/phoebebright/3098488>
- Changing the colour of an axis in v4. (2019). Retrieved from <https://bl.ocks.org/d3noob/629790fc15cc1afba0253f29a4d246e7>
- creating-a-rotating-globe. (2019). Retrieved from [https://subscription.packtpub.com/book/web\\_development/9781783286270/11/ch11lvl1sec47/creating-a-rotating-globe](https://subscription.packtpub.com/book/web_development/9781783286270/11/ch11lvl1sec47/creating-a-rotating-globe)
- d3.js ~ Streamgraph. (2019). Retrieved from [https://unpkg.com/d3@2.1.3/\\_site/ex/stream.html](https://unpkg.com/d3@2.1.3/_site/ex/stream.html)
- d3.js, H., & Jurković, A. (2019). How to update axis using d3.js. Retrieved from <https://stackoverflow.com/questions/16919280/how-to-update-axis-using-d3-js>
- D3, C., & Kotthoff, L. (2019). Change domain in D3. Retrieved from <https://stackoverflow.com/questions/10720915/change-domain-in-d3>
- Five Design Sheet | Design Methodology for Visualisation. (2019). Retrieved from <http://fds.design/>
- Holtz, Y. (2019). Most basic dendrogram in d3.js. Retrieved from [https://www.d3-graph-gallery.com/graph/dendrogram\\_basic.html](https://www.d3-graph-gallery.com/graph/dendrogram_basic.html)
- Jana, A. (2019). Create a simple Donut Chart using D3.js - A Developer Diary. Retrieved from <http://www.adeveloperdiary.com/d3-js/create-a-simple-donut-chart-using-d3-js/>
- Learn to create a line chart using D3.js. (2019). Retrieved from <https://www.freecodecamp.org/news/learn-to-create-a-line-chart-using-d3-js-4f43f1ee716b/>
- TC2000 Widgets & Gadgets. (2019). Retrieved from <https://widgets.tc2000.com/>
- Yang, Y., & Marriott, K. (2019). Creating Visualisation in D3. Retrieved from <https://5147.yalongyang.com/book/module05/activity-creating-visualisations-with-d3.html>
- Yang, Y., & Marriott, K. (2019). Five Design Sheet Methodology. Retrieved from <https://5147.yalongyang.com/book/module01/activity-five-design-sheet-methodology.html>



# APPENDIX

## Sheet 1

**1) Ideas**

ABC 1234 | XYZ 782 | AAPL 1279 | AMZ

**2** AAPL  
AMZN  
GOOGL  
PCLN  
OCL

**3** CATEGORY

**4** Rotating map  
with company density heatmap

**5** A changing line

6 - lines  
7 - area map  
8 - stacked areamap  
9 - horizon chart  
10 - stream graph  
11 - Donut group  
12 - Bars

Filters

1 2+3  
5 6 7 8 9  
4

Maybe not  
11/12.2

**SHEET 1**

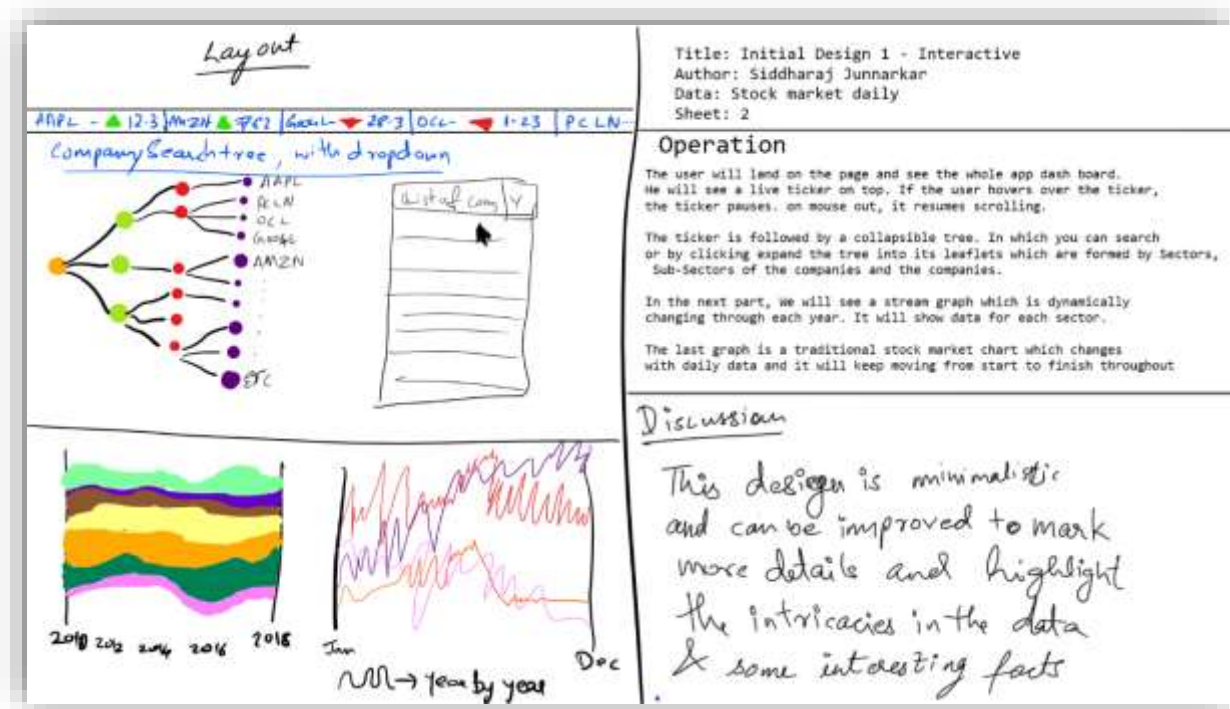
**Solution**  $\Rightarrow 1 + 2 + 3 + 7 + 8 + 10$   
 $\quad \quad \quad 2 + 4$

$\Rightarrow 2 + 3 + 4 + 5/6/7$   
 $\quad \quad \quad + 12 \text{ (any one)}$

$\Rightarrow 1 + (6 + 7 + 8 + 9 + 10 + 11 + 12)$   
 $\quad \quad \quad \text{interchanging amongst each other}$

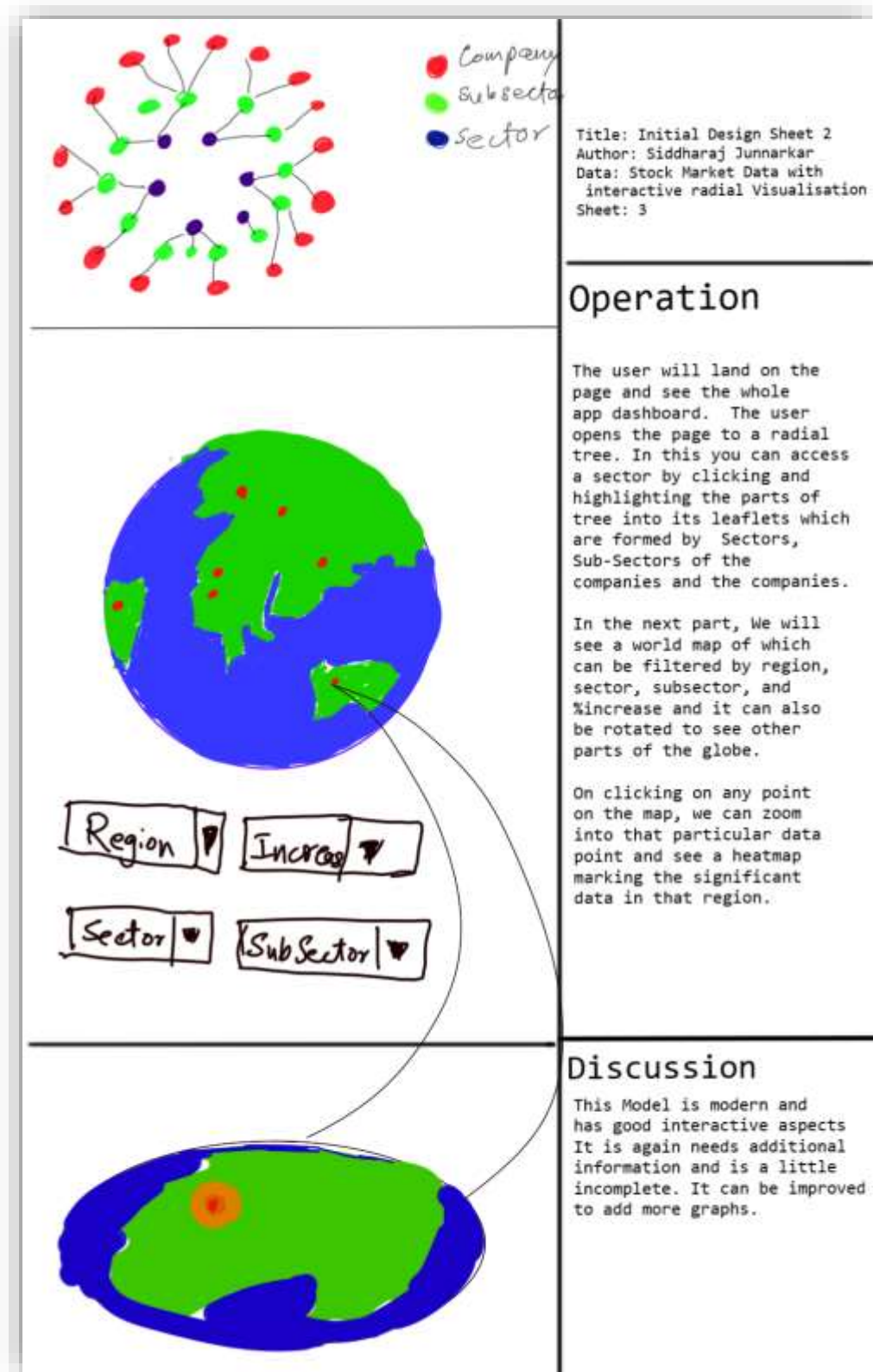
**Combine & refine**

## Sheet 2

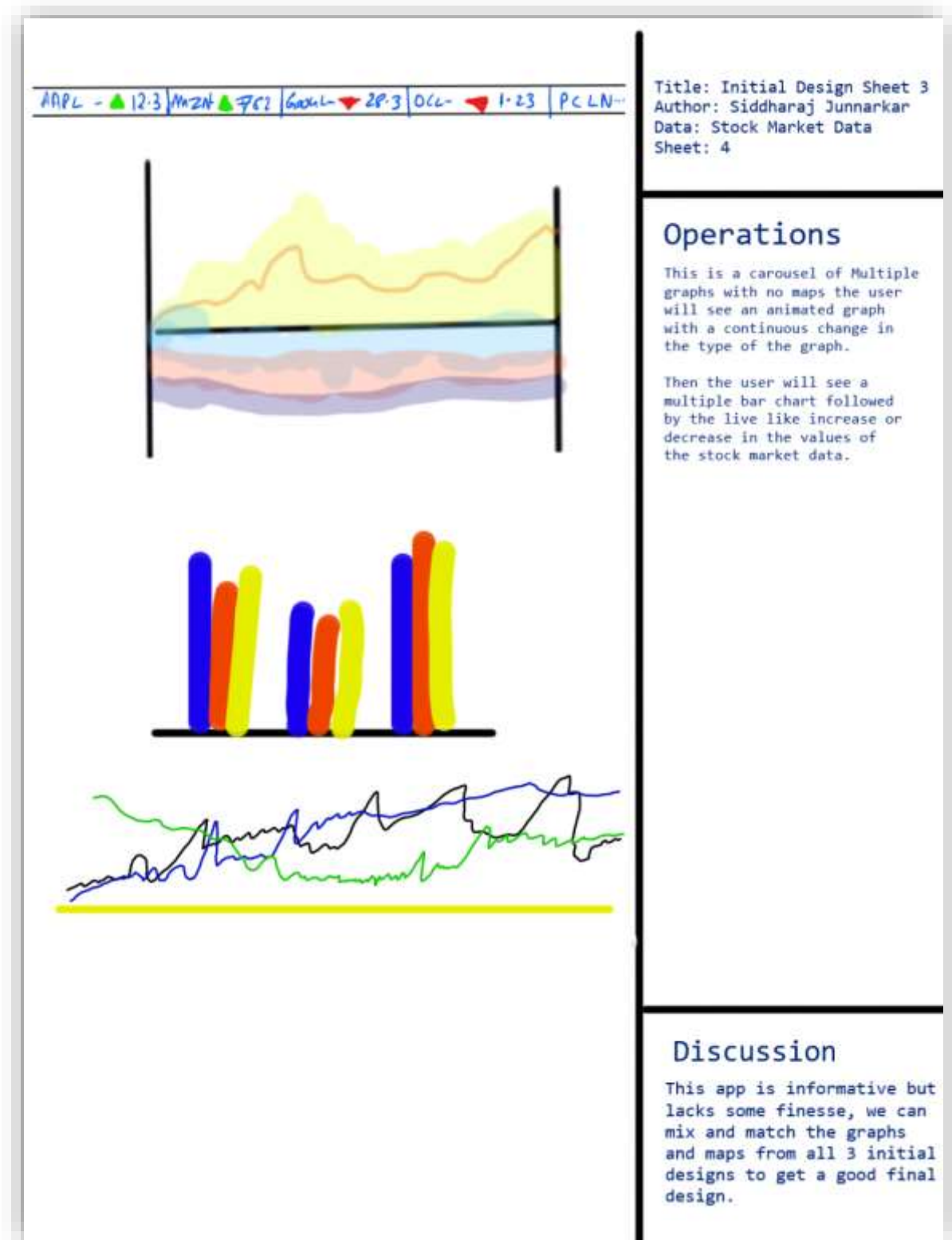




## Sheet 3



## Sheet 4



## Sheet 5

