

Visualizing Financial Trends & Sentiments in Stock Market

Name	Email	Spire ID
Riddhi Maniktalia	rmaniktalia@umass.edu	34823211
Owen Ludlam	oludlam@umass.edu	32446448
Shreyans Babel	sbabel@umass.edu	32155226

Link to GitHub repository: <https://github.com/Snow-cannon/CS571-Finance-Sentiment>

Background & Motivation

As newbies in the field of stock markets, we are developing this project from the fundamental need to understand the complex factors driving the stock market performance. It will also be helpful to other investors and analysts who are constantly deciphering the meaning hidden behind the financial data and public sentiment. We realised that the traditional financial analysis of stocks often overlooks the dynamic influence of news, so we decided to include it in our project.

The motivation behind it is to give a comprehensive view of company finances and the effect of related news sentiment on stock prices. We aim to bridge the gap between the two realms of quantitative and qualitative information regarding financial markets. It will also help investors to get a more holistic view of the market dynamics. From a student perspective, it offers a practical and engaging way to apply theoretical knowledge to real world scenarios. We plan to study a decade of data and this will allow us to study the different economic cycles on a quarterly and annual basis.

Project objectives

Primary questions:

1. How do financial statements (cash flow, income statements, balance sheets) correlate with stock price changes?
2. How much cash does each sector earn over time?
3. Does sentiment analysis of news summaries provide useful insights into financial trends?
4. How does revenue growth or decline impact stock price volatility?
5. How do companies with similar financial profiles perform against each other over time?
6. Do companies with strong cash flow and balance sheets experience less volatility?

Optional Questions:

1. How do individual companies perform compared to their sector trends over time?

What we aim to learn & accomplish

- Identify trends and patterns in how financial statements relate to stock price movements.
- Compare financial health across companies and sectors.
- Explore the impact of external factors (news sentiment) on financial performance.
- Develop visual storytelling techniques that make complex financial data easy to understand.
- Assess sector-wide behaviors and how they evolve over time.

Benefits of learning & accomplishing these goals

- Improved financial literacy
- Market insights
- comparative analysis
- Data driven decision making
- Potential for predictive insights

Data

Our dataset will include 50-70 companies spanning a period of 10 years (2016-2024) across 11-12 stock market sectors, focusing on the top 5-6 companies per sector based on market capitalization and industry relevance. For each company, we will look at their financial statements such as cash flow, income statements, and balance sheets which show how the company earns and spends cash. We will also look at the API provided sentiment of news articles mentioning each company and bucket them into Bearish / Bullish categories to compare sentiment to stock prices. The data will be collected from multiple financial sources and APIs which are listed below.

Sources: [Alpha Vantage](#), [Polygon](#), [Yahoo Finance](#), [Kaggle](#)

Derived Attributes:

- Company and sector based sentiment aggregation
- based sentiment aggregation
- Frequency of words from news summaries
- Word-specific sentiment aggregation
- Summation of income/balance/cash statements terms to reduce data size
- Sector cash flow aggregation
- Sector company count

Data processing

Challenges that we might face during data processing are:

- **Handling missing data:** Generate estimates for stock price over time data (normalizing / smoothing). Manually acquire data from other sources (Company/sector description, etc.)

- **Aggregating data:** Structure and combine acquired datasets according to project requirements using SQL tables and aggregation queries to calculate the derived attributes
- **API limitations:** Structure project based on API limitations (Example: [Alpha Vantage](#) only allows 25 calls/day per API key)

Must have features

- Stock price visualizations over time
- Cash flow, income statement & balance sheet visualizations
- Aggregate sentiment analysis per company over a time period
- Company wise overview
- Company wise financial insights
- Sector wise financial insights
- Interactive selection of companies and sectors

Optional features

- Comparison overlays for stock prices vs sentiment
- Option for dark / light mode
- Zoom in on stock graph
- Mobile phone compatibility

Project schedule

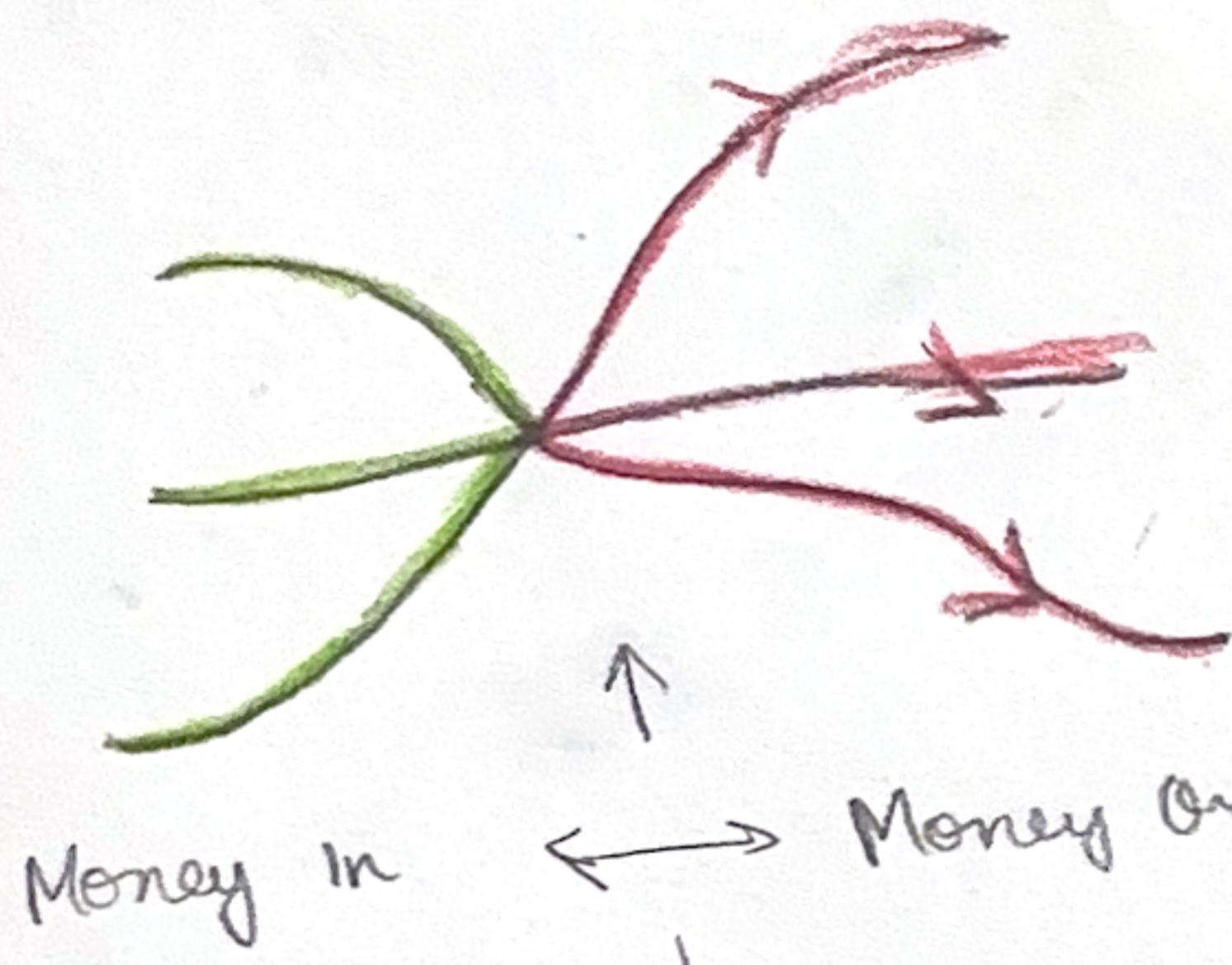
- *Week 1:* Setup API and create data extraction pipeline
- *Week 2:* Set up database and preprocess per-company financial data
- *Week 3:* Develop line chart and company overview
- *Week 4:* Develop Sankey diagram, slider, and dropdown
- *Week 5:* Develop the Speedometer, word cloud, and company selection table
- *Week 6:* Develop sector bubble chart, radar chart, sector overview and prepare for mid project milestone
- *Week 7:* Implement useful peer review feedback
- *Week 8:* Connect selection table to speedometer and company financials / stocks and implement hovering capabilities for company financials
- *Week 9:* Connect sector section on bubble chart to radar /overview
- *Week 10:* Implement hovering on sector bubble chart
- *No more weeks*

IDEAS

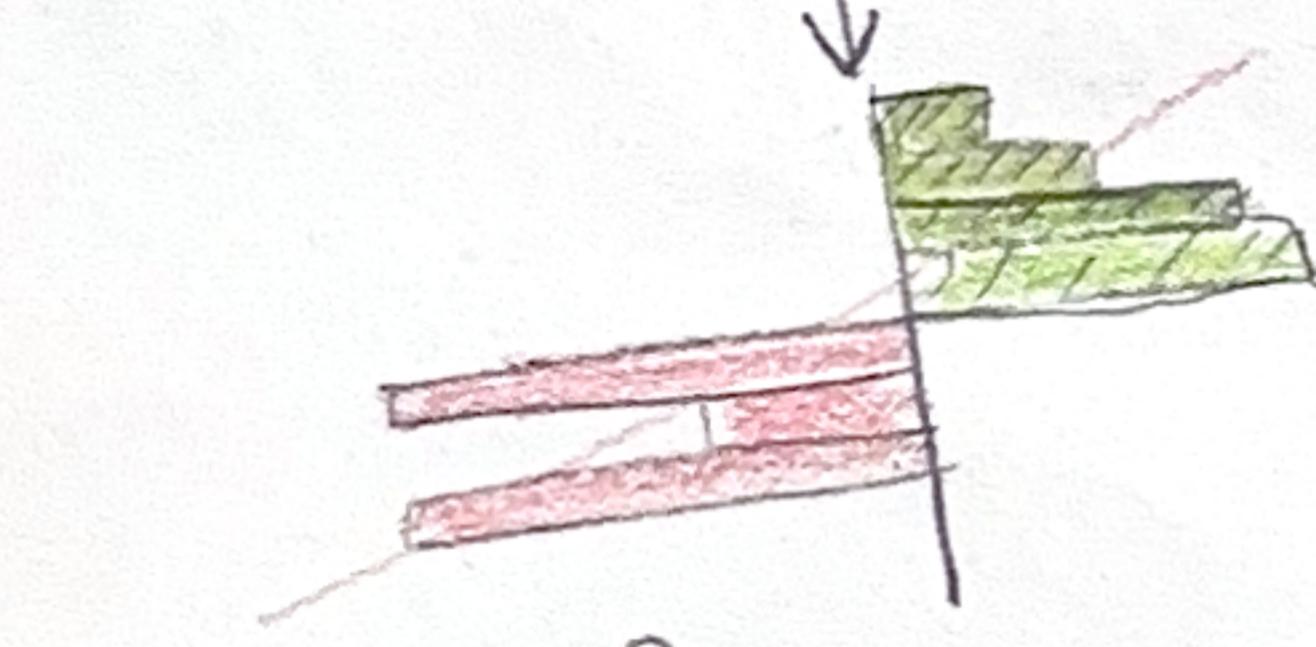
Financial Data

Fundamental

- Balance sheets
- Cash flow
- Income statements
- Articles / sentiments
- Company overview



Money In ←→ Money Out



For quarters?
Dropdown → Sliders

FILTER

finalised on,

- money in-money out
- senky visualizations
- sentiment speedometer
- word cloud
- dropdown for quarter selection
- bubble chart
- line chart

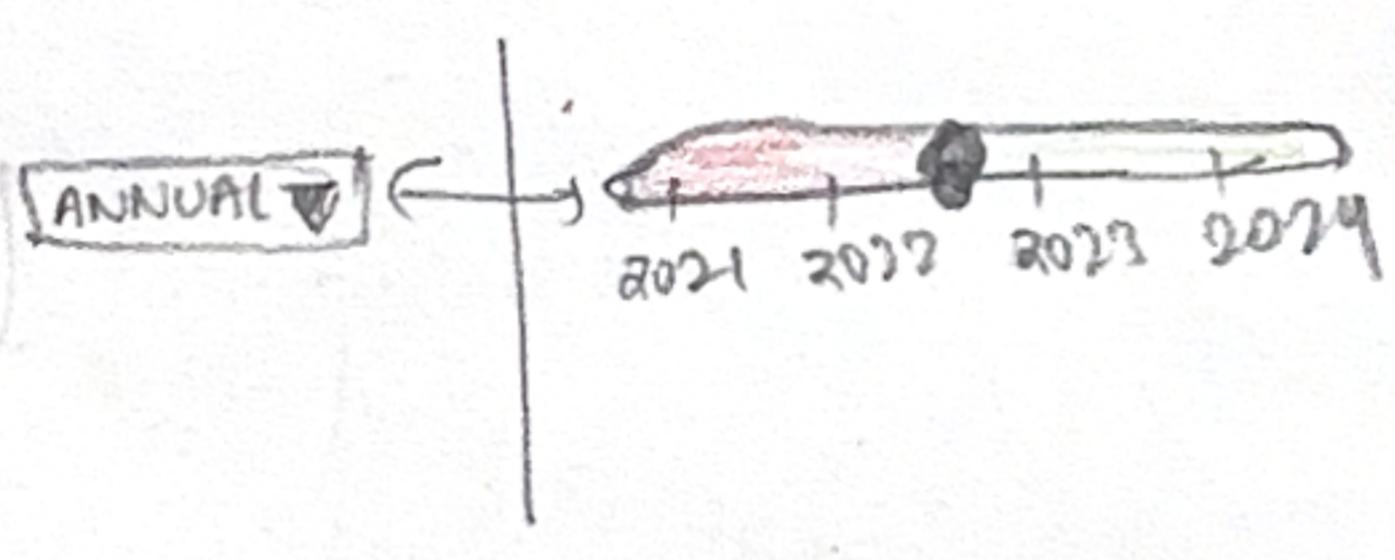
Metadata

- Definitions
- Sector names
- GDP
- Technical indicators

- Markets
- Stocks
 - Cryptos
 - Commodities
 - Fintech

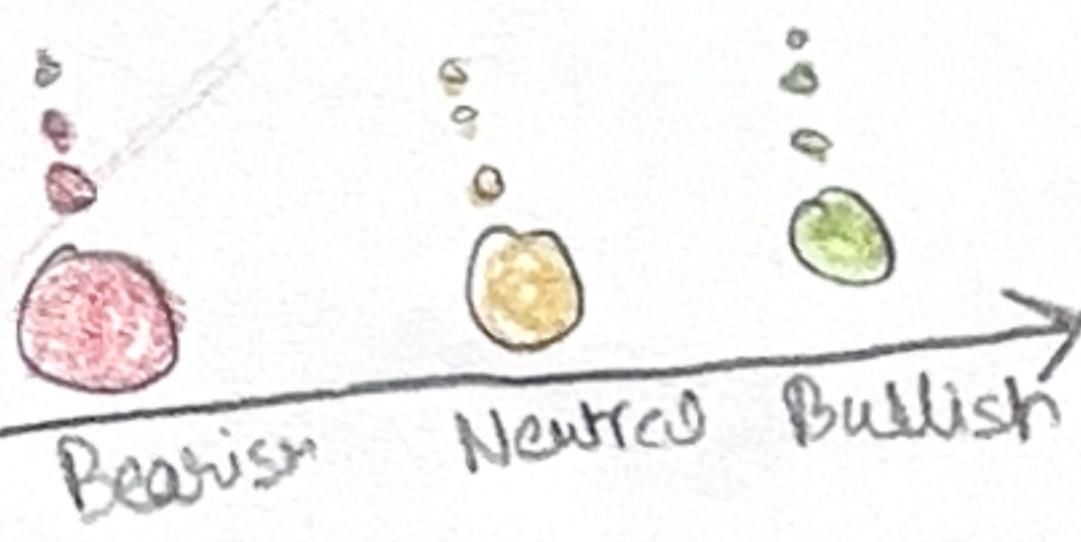
Stock prices

- Price over time
- [1 day] / [5 min intervals]



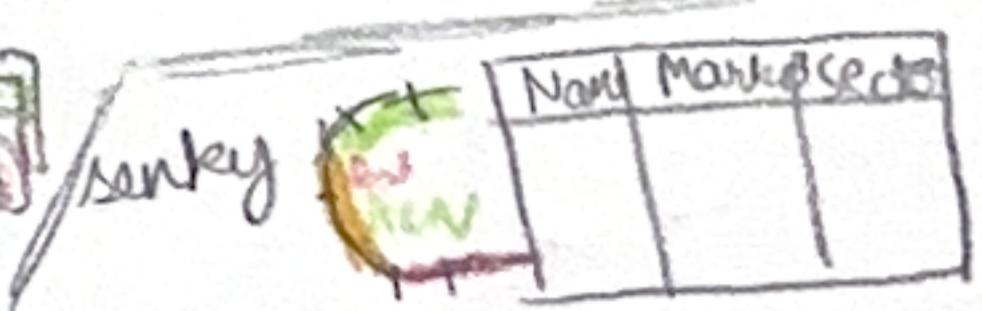
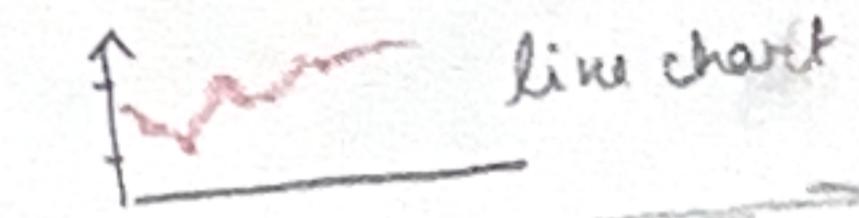
Inflation
→ Dogs
\$ Million
Billion

Books Word Cloud

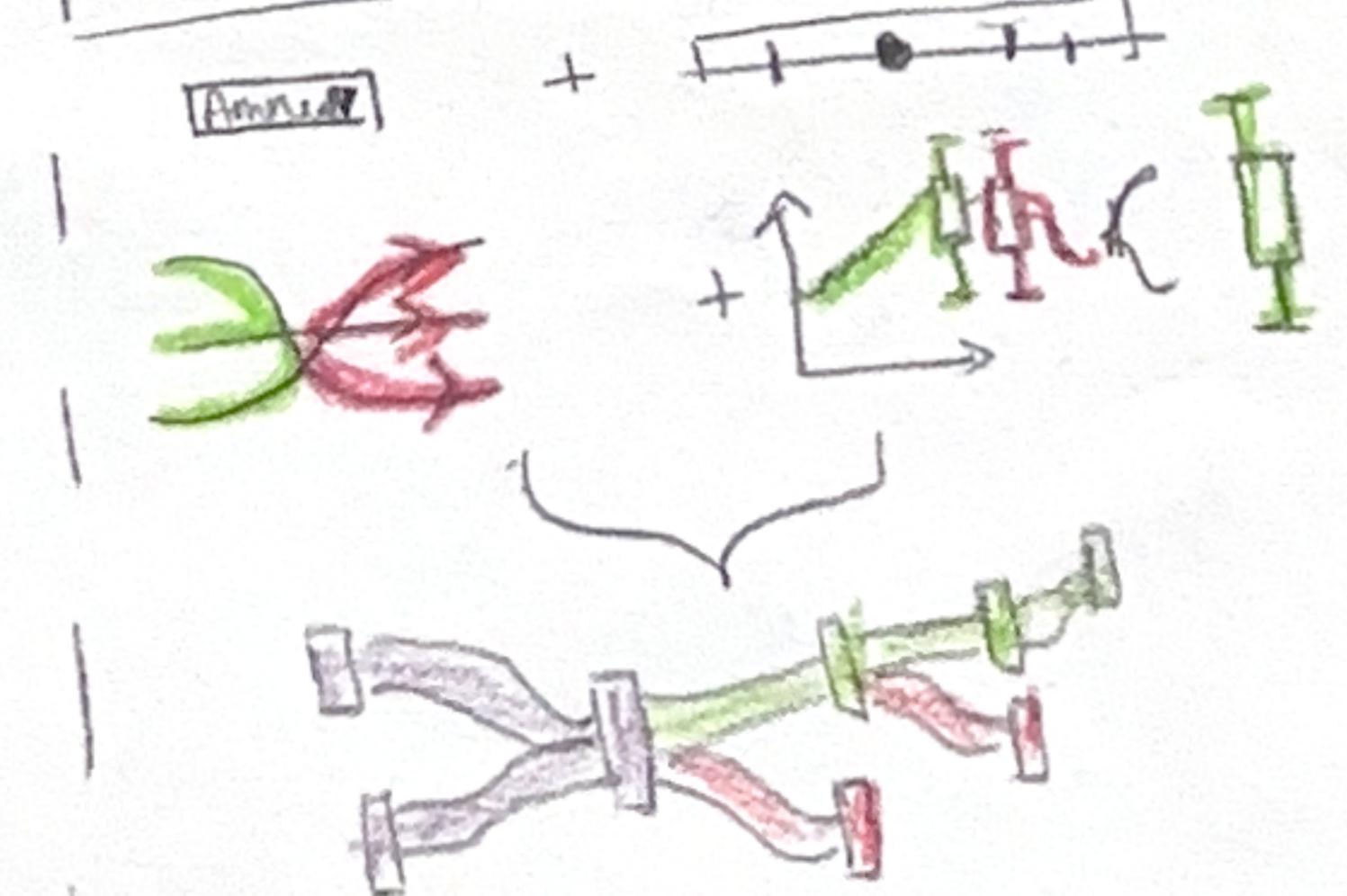


COMBINE & REFINER

Non-Example Company
Symbol



CATEGORIZE

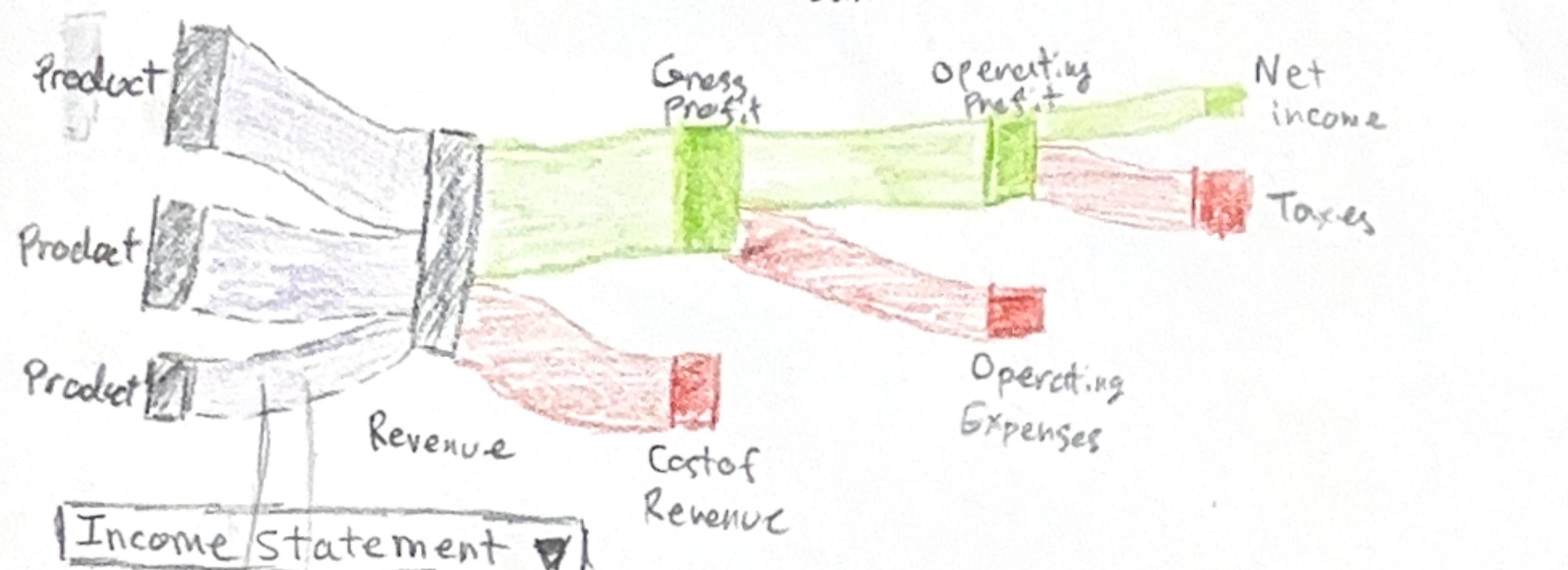
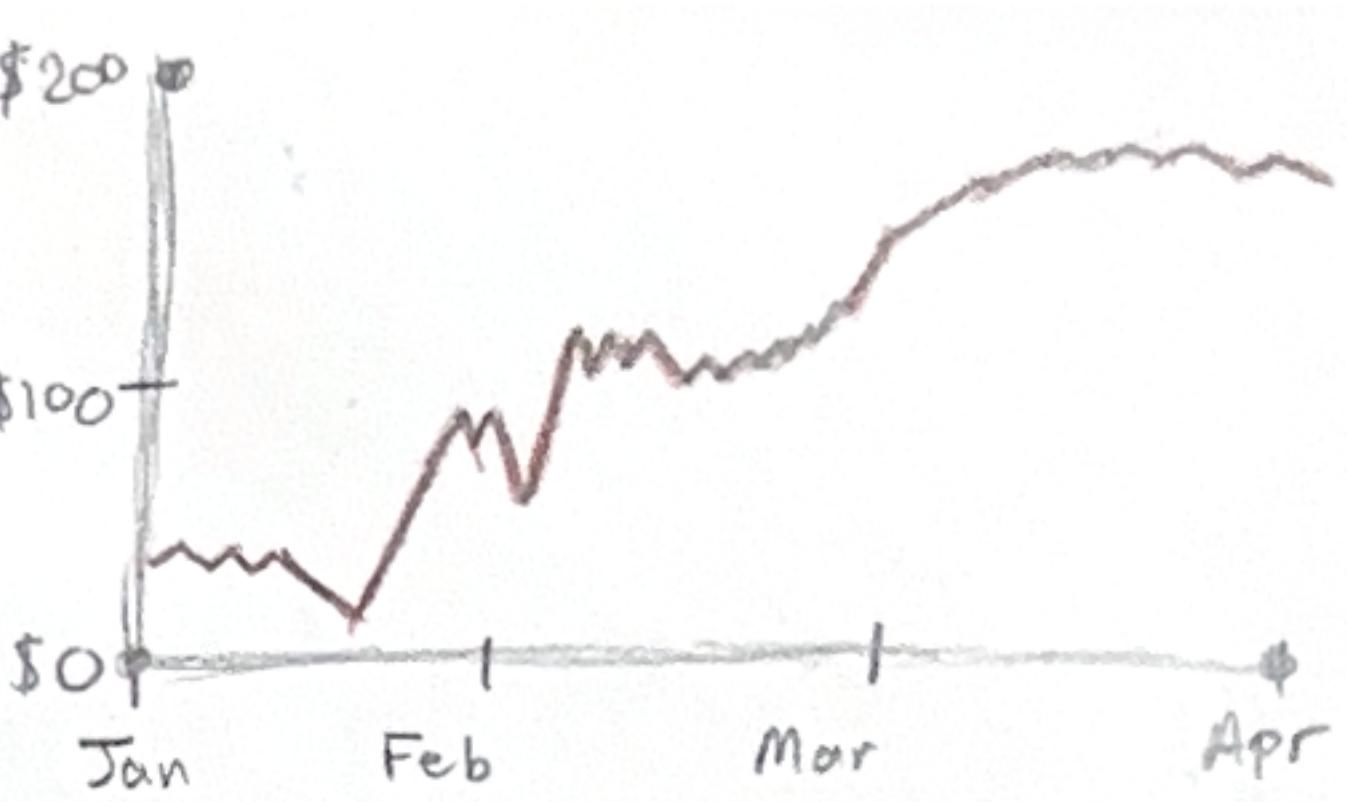


QUESTIONS

- ✓ 3 unique designs
- ✓ no lies
- ✓ effective tasks

Pros - comprehensive
User friendly
Interactive
Cons - subjective
Article sentiments

Name: Example Company Name
 Symbol: ECN
 Sector: Example Sector
 Industry: Example Industry
 Website: www.ecn.com



Income Statement

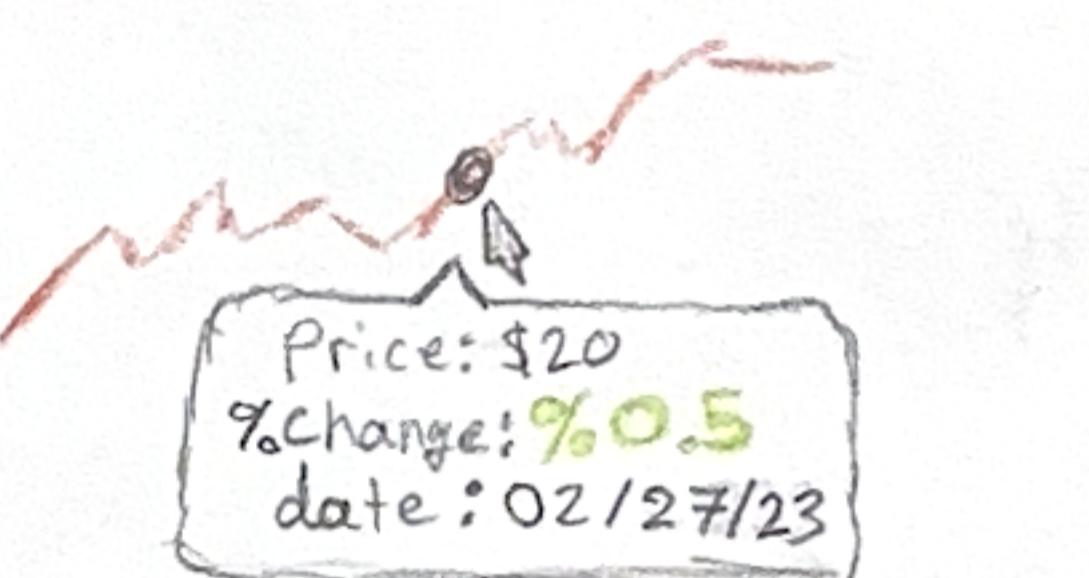


Layout

Focus

data-set:

- Cash flow
- Balance sheet
- Income statement



Display day-level information on stock line hover

Change line color based on overall profit/loss

Source: A
Target: B
Amount: \$50B

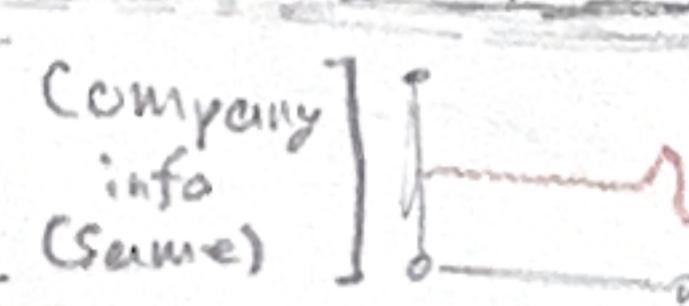
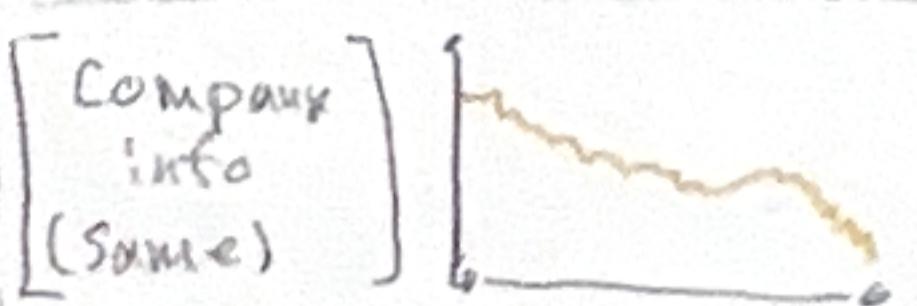
Name: A
Amount: \$60B
Description: IS A

Iteration #1

Iteration #2

Iteration #3

Quarterly



Positive stock (line chart)
Good income (sankey)

Low stock
Low income

Neutral Stock
Low income

Title: Company stock vs Financials

Authors: Owen Ludlam,
Shreyans Babel,
Riddhi Maniklal

Date: 2/24/25

Sheet: Initial Design 1, Pg 2

Task: Fundamental Analysis
of individual Company stock
and financial reports

Operations

- Users can select 'Yearly' and 'Quarterly' results from a dropdown.
- Users can use a slider to select which year/quarter they wish to view.
- The slider will change range based on if Year or quarter is selected.
- The financial and stock graph will update to represent data from the selected time period on the slider.
- Hovering over the stock chart line will display that data point's Price, Percent change, and date.
- Users can select between cash flow, balance sheet and income statement. This will update the financial chart to represent the selected data.
- Hovering over a link or node will display the amount, name, and description of the hovered item.

Discussion

Advantage:

- Comprehensive financial report overview
- High interactivity

Disadvantages:

- Sankey graphs may be hard to interpret.
- Color blindness is not taken into account.

Suitable for task: Accurately displays correlation between stock prices and financial statements.

Feasible: Yes

Scalable: Yes, by time and company

Clear design: Yes. It is separated into clear sections.

Title: News Sentiment Word Cloud

Author: Owen Ludlam,
Shreyans Patel,
Riddhi Maniktala

Date: 2/25/25

Sheet: Initial Design 2, pg 3

Task: Compare sentiment to frequent words in news articles of a company over a time period.

Operations

- Users can select the referenced company from the company selection table by clicking a row.
- Users can change selected annual vs quarterly from initial design 1.
- Users can select timeframe from slider in initial design 1.
- Users can sort the company table by selecting column headers in the company table.
- Word size in the word cloud shows the frequency that word appears in related news articles compared to other words in the cloud.
- Hovering over a word displays the word frequency in a pop-up by the mouse.
- Speedometer displays the aggregate sentiment for the selected company in the specified timeframe, graded into 5 buckets.
- Word color represents the sentiment of the articles it was present in.

Discussion

Advantage: Word cloud brings natural linguistic description to the sentiment.

Bucketing sentiment makes interpretation beginner friendly.

Disadvantages: No filtering on the table is inconvenient.

Scalable: Usable with any number of companies. Word sentiment may be challenging.

Feasible: Yes.

Clear design: Yes. Simplistic with natural language.

Name	Market cap	Sentiment	Sector
Comp B	\$5B	Bullish	Tech
Comp C	\$7B	Neutral	Tech
Comp D	\$2B	Neutral	Retail
Comp E	\$3.5B	Bearish	Tech
Comp F	\$17B	Neutral	Food
Comp G	\$12B	Neutral	Food
Comp H	\$11B	Neutral	Tech
Comp I	\$6B	Neutral	Retail
Comp J	\$5.5B	Bearish	Tech

Layout

Focus

Comp B	Bearish	Tech
Comp A	Bullish	Tech

User selects new company

Comp B	Bearish	Tech
Comp A	Bullish	Tech

Data Set:

Company related sentiment and frequent words

Name	Sentiment
Comp H	Bullish
Comp B	Bearish
Comp C	Neutral

Name	Sentiment
Comp A	Bullish
Comp C	Neutral
Comp B	Bearish

data set
company specific
sortable data

Title: Sector Overview Analysis

Author: Owen Ludlam
Shreyans Babel,
Riddhi Namititalia'

Date: 2/25/25

Sheet: Initial Design 3, Pg 4

Task: Analyzing company cash flow and sentiment by sector.

Operations

- Users can select time period with the slider from initial design 1.
- Users can select the sector by clicking the bubble that represents it.
- Selecting a sector updates the radar chart to display the sector cash flow.
- Selecting a sector updates the sector description table with that sectors information.
- Radar chart will display 5 different cash flow inputs for the selected sector.
- Hovering over a sector bubble will enhance the border to show the user the clickable sector.
- Hovering over a bubble will display the sector name under the mouse.

Discussions

Advantages:

- Easy multidimensional way to compare between different cash flows per sector.

Disadvantage:

- Difficult to interpret quantified sector values from bubble size

Scalable:

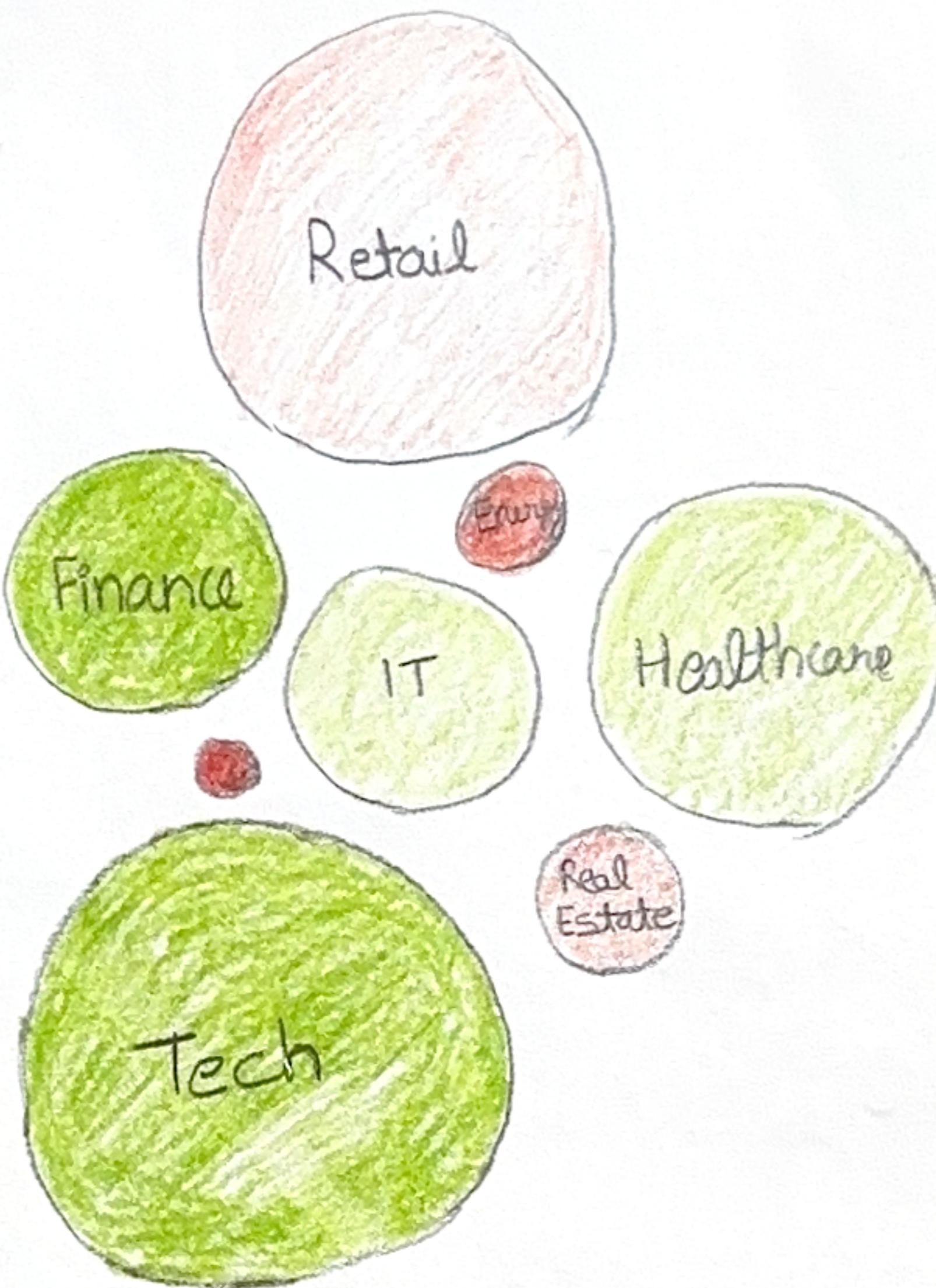
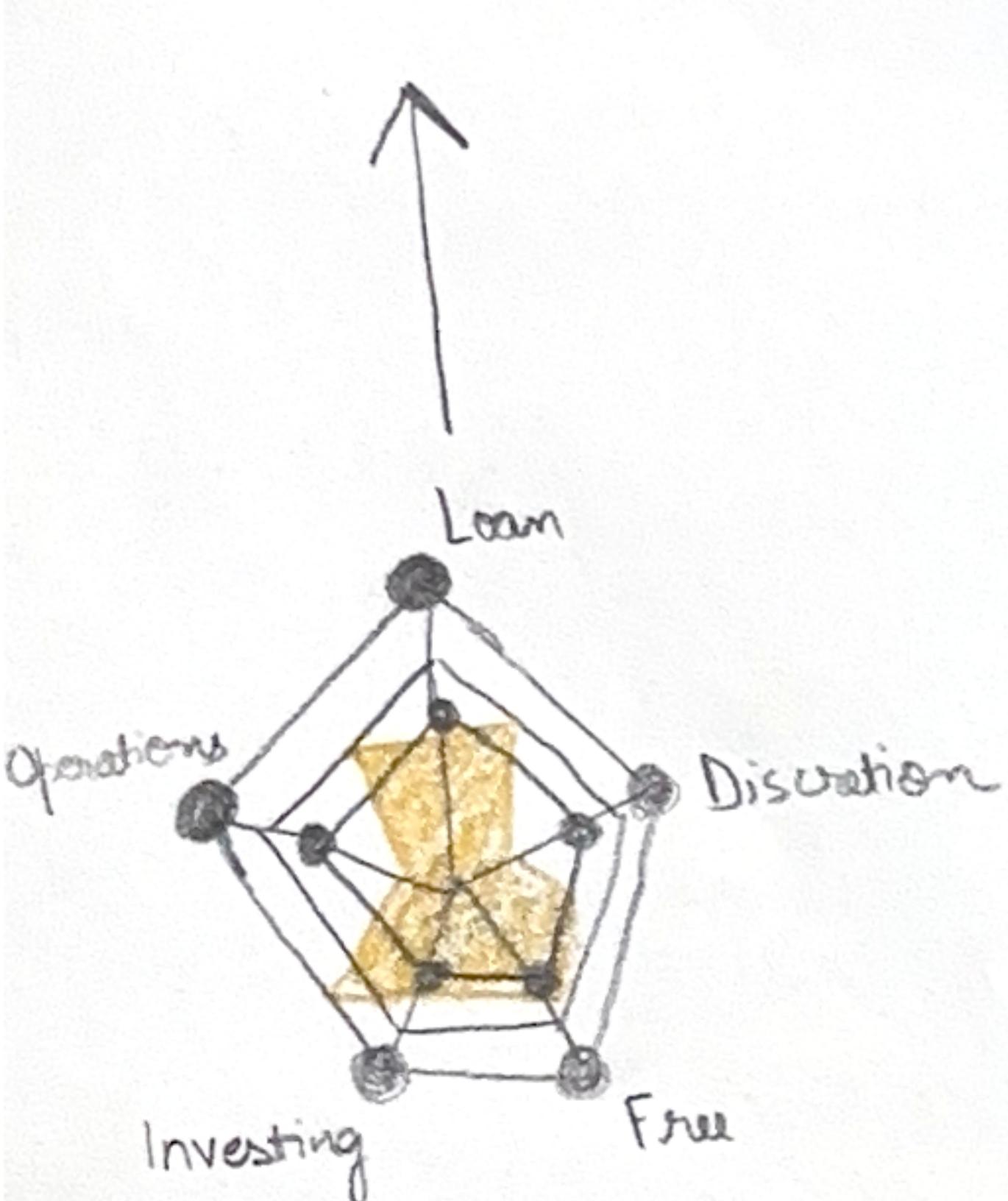
- Further breakdown of sectors would make it difficult for the user to understand the bubble chart

Clean design:

- Yes, minimal entities on the screen

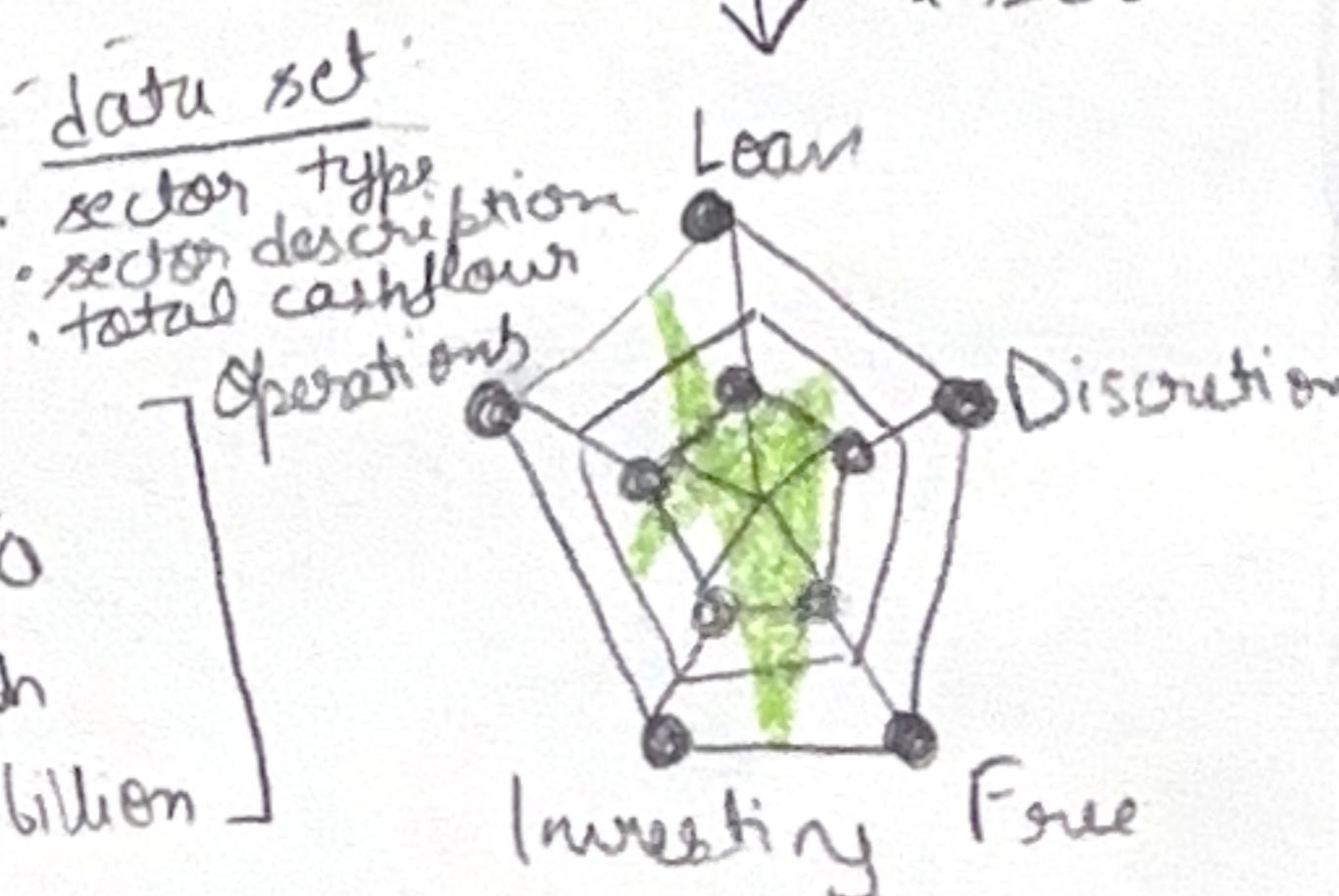
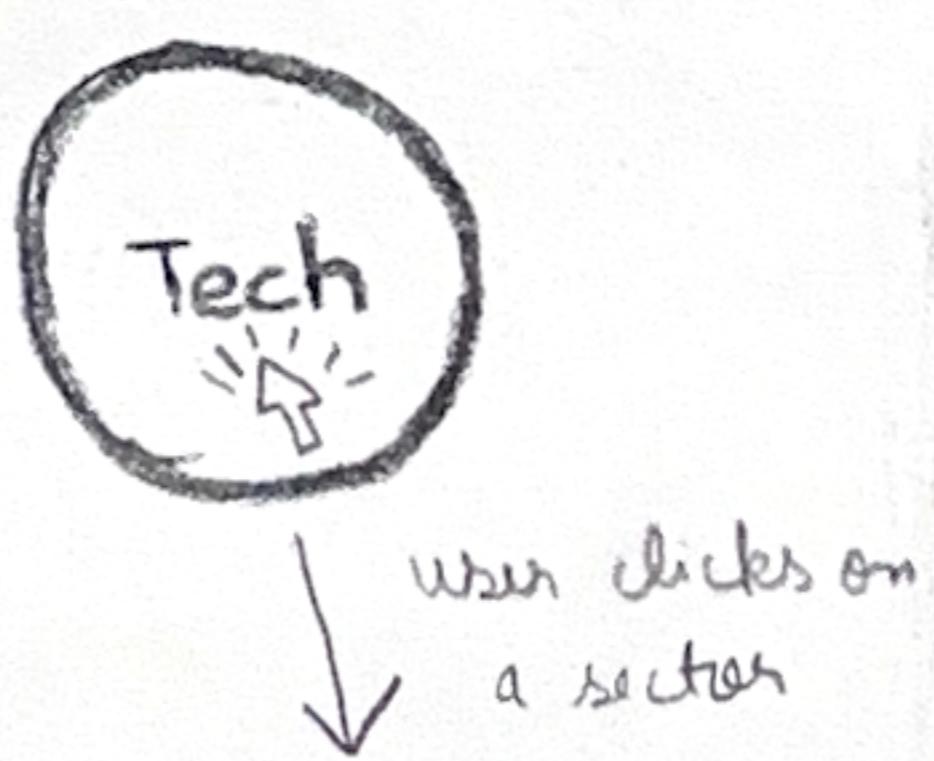
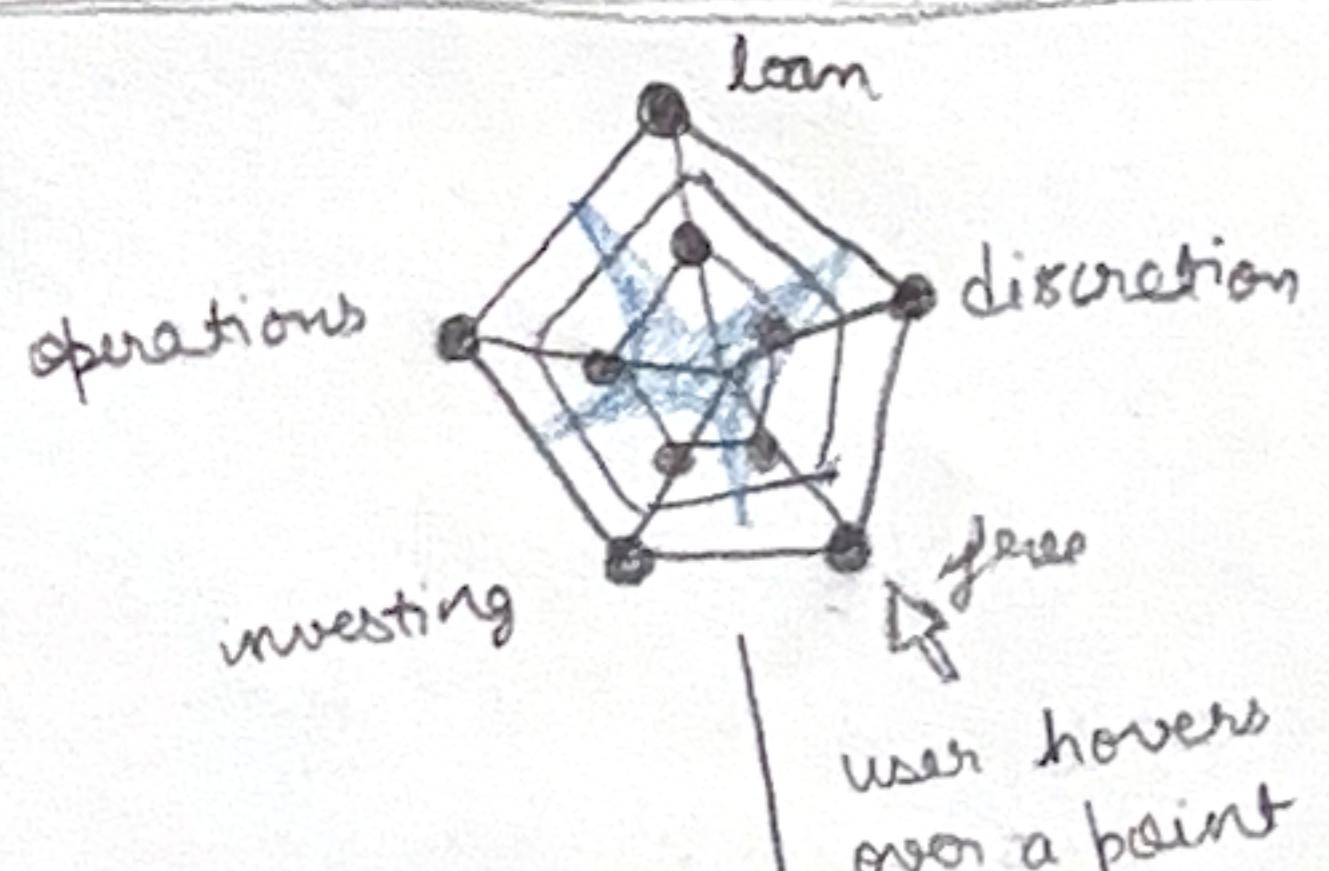
Feasible: Yes

Tech
Company count: 50
Sentiment: Bullish
Total cash: \$53 billion



Layout

Focus



data set:
• cash per sector
• cash type
description

[Cash: \$10 million
Description of the source...]

once a user hovers over a sector, it gets enhanced and allows the user to click on it. Once clicked the radar chart gets updated, as well as the sector description table.

[Tech
Company count: 50
Sentiment: Bullish
Total cash: \$53 billion]

Title: Visualizing financial Trends & Sentiments in Stock Market

Author: Owen Ludlam,
Shreyans Babel,
Riddhi Maniktala.

Date: 2/25/25

Sheet: Realization, Pg 5

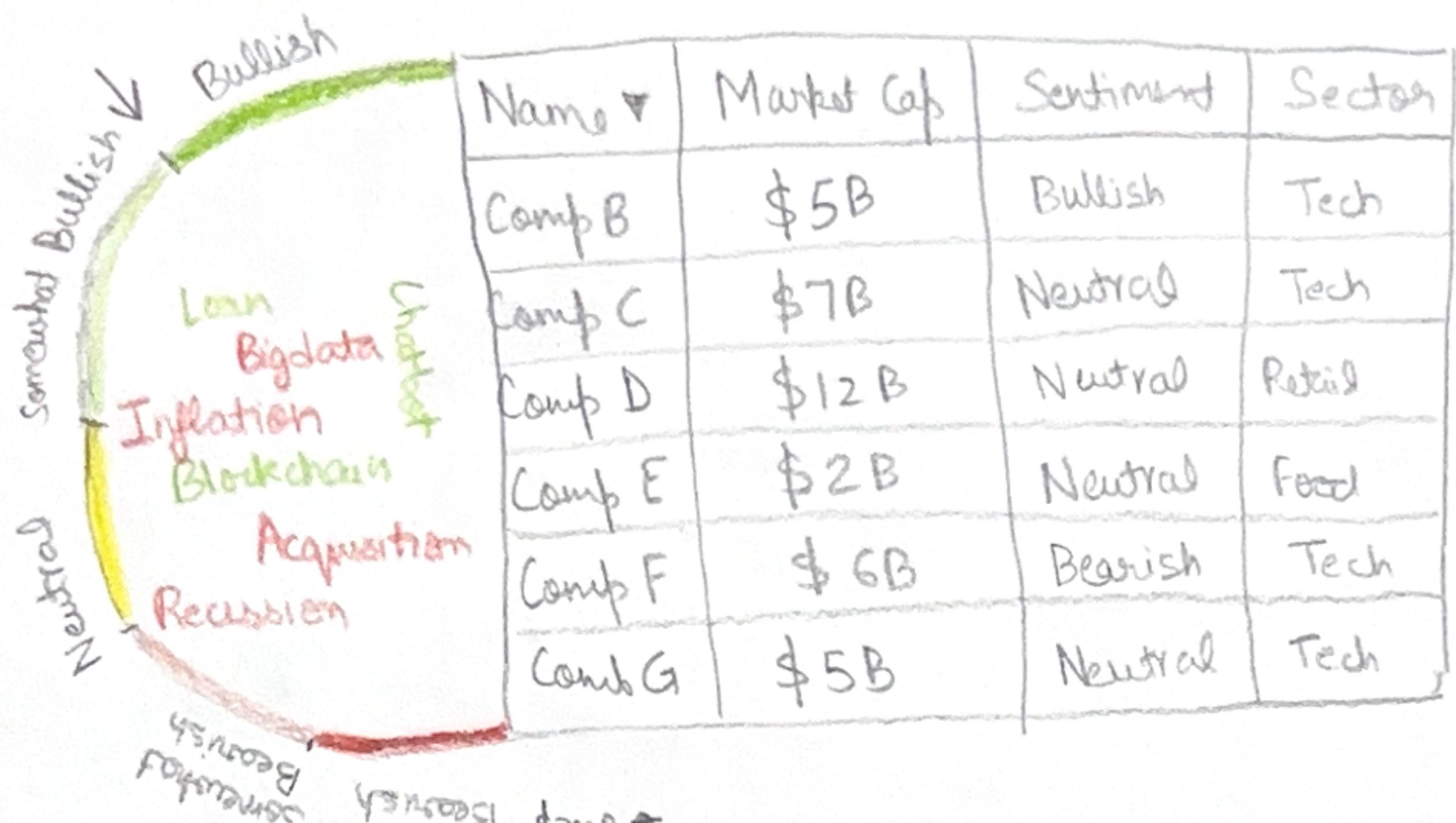
Task: Final Design using 2 per company & 1 per sector visualization

Operations

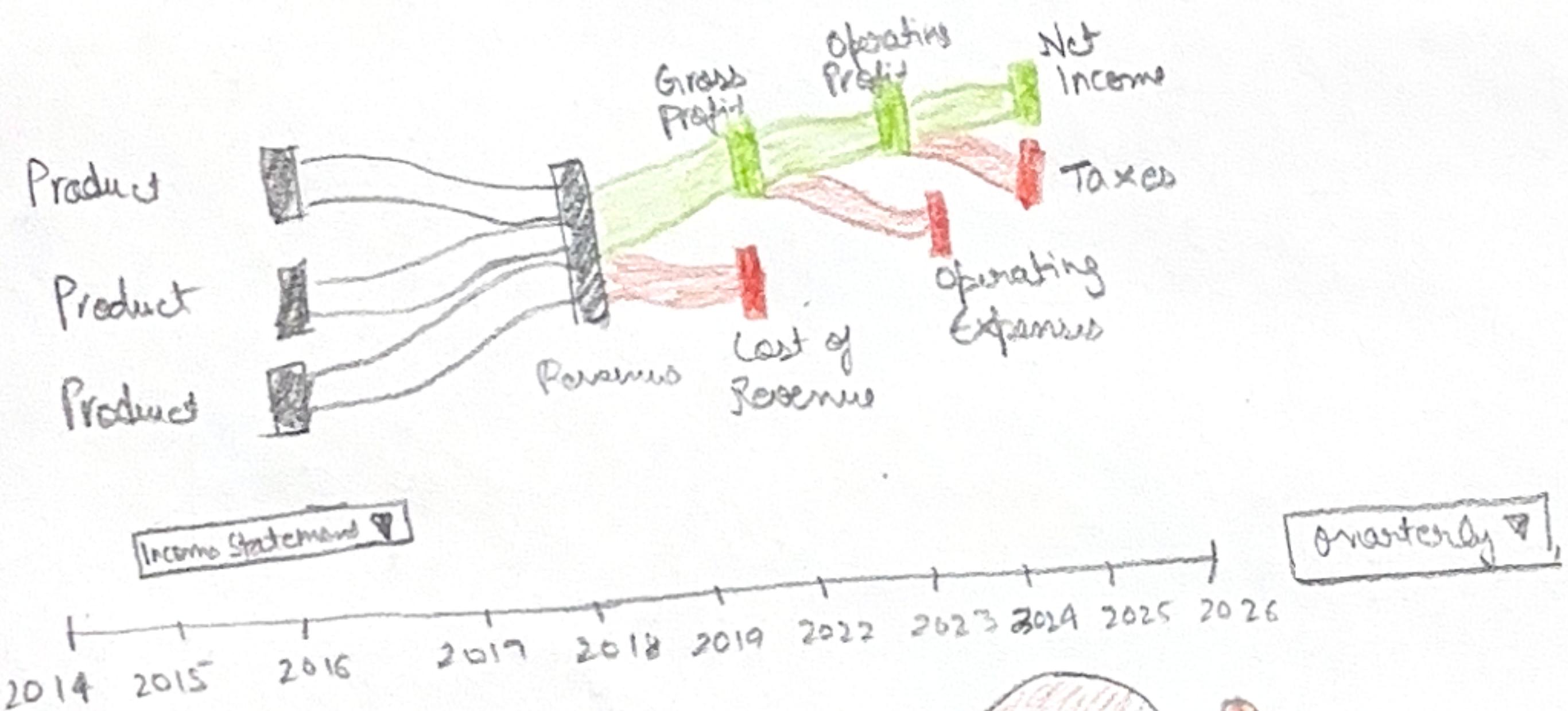
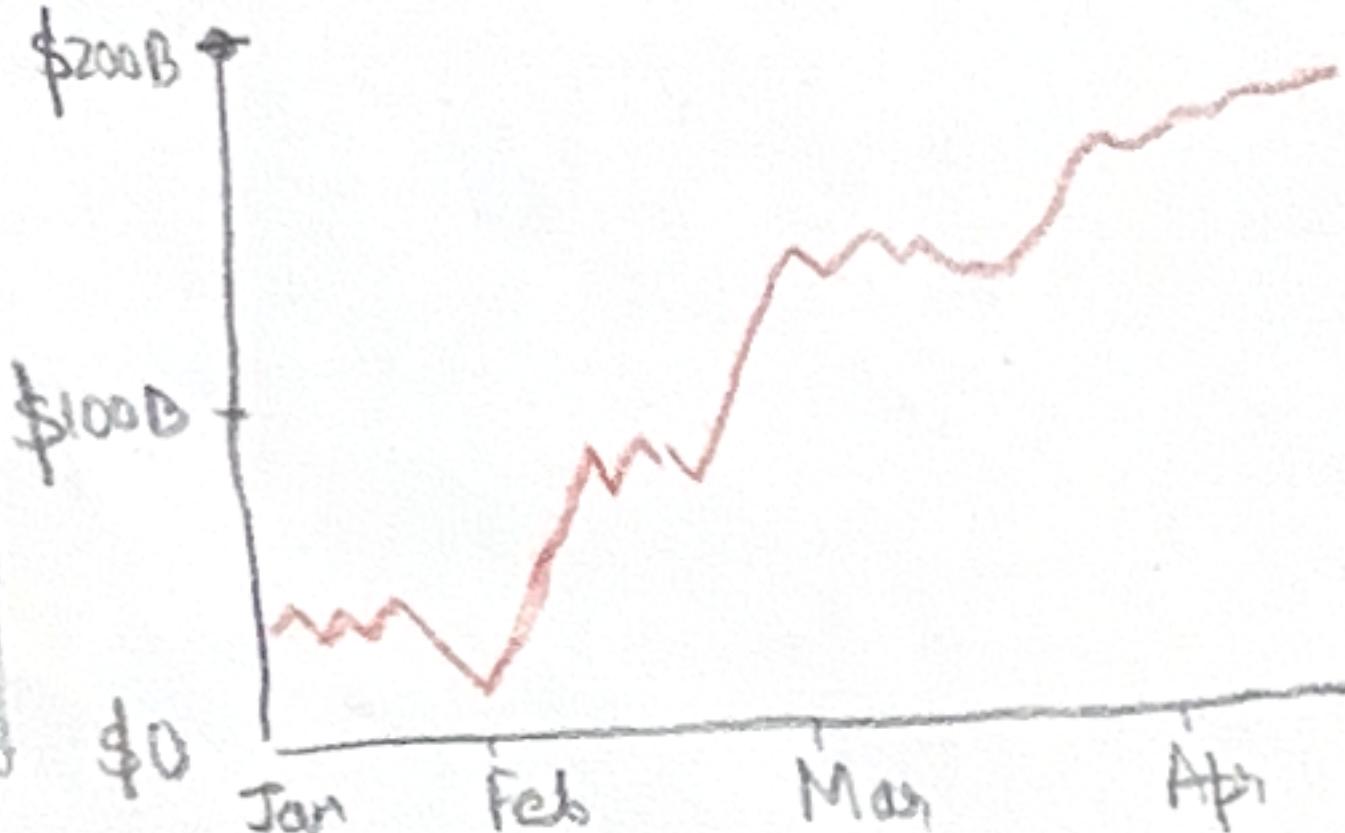
- user selects a company from companies list, and a summary table appears about the company
- all visualizations for per company get updated
- speedometer will show the sentiment analysis of the company
- wordcloud will visualize the articles most used words on the basis of which the sentiment score is calculated
- user can also switch between annual / quarterly analysis using a dropdown, as well as select a year through a slider
- stock price over time line chart gets updated based on the user's demands
- sunburst graph will have the option to visualize the company's income statement, balance sheet & cash flow
- Bubble chart & radar chart can also be analysed for per sector visualizations

Discussions

- 30 hours for implementation
- Design patterns
 - change red green color palette to color friendly
- Calculations
 - lots of data aggregation & bucketing for time frames
- Software dependencies
 - python based API data collection
- Requirements
 - Hardware: NA
 - Software: SQL data storage



Name: Example Company Name
Symbol: ECN
Sector: Example Sector
Industry: Example industry
Website: www.ecn.com



Tech
Company count: 50
Sentiment: Bullish
Total cash: \$53B

