Assignment M3

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***Abstract*—** The project is to design the search function (search bar and the search results) in an investment website. This could be a stockbroker, or an investment information website. As these websites can be complex with a large volume of information, the search bar can be used for the task of accessing market information or investment opportunities in a faster manner compared to the website navigation menus

1 BRAINSTORMING PLAN

1. Generate at least 10 ideas, aim for 20
2. Spend at least 60 minutes in total, spread out across at least two days
3. Stay focused on the problem definition/problem space – write it at the top of the paper
4. Have at least 3 ideas which need significant technological innovation (i.e., not implementable using current commercially available tech/needing significant R&D)

2 BRAINSTORMING EXECUTION

I have split the interface into two components – the search input and the search output. Brainstorming was done for each of the components separately and then jointly.

The brainstorming sheet is given in appendix 1.

After brainstorming I came up with five ideas for the search input, five ideas for search output. Any of the five search input ideas can be combined with any of the five search result ideas giving a universe of 25 ideas for the full interface. Additionally, there are two ideas of combined implementation of search input and output using Chatbots and advance NLP, leading to total **of 27 ideas (**Error! Reference source not found.**)**

All the ideas can be further extended by input & output language translation and voice-based interaction.

The brainstorming has met the criteria defined in section 1 (27 ideas for the interface, total time spent ~ 3 hours across two days, 3 ideas need significant R&D (Conversational NLP search, search results as 3D graph in VR/AR, search results in 3D grid in VR/AR are technologically)

Table 1 — Results of Brainstorming for design ideas

Search Input	**Search Results**
Separate Implementation	
1. Static/conventional search bar	1. Conventional flat list
2. Dynamic search bar– the search suggestions will be uncategorized	2. 2D grid – Topic vs results or Result type vs Search results
3. Dynamic search bar – the search suggestions will be categorized	3. 3D grid – Topic vs. Result type (article, image, video) vs. Search results (VR/AR tech needed)
4. Pre-selected categories → conventional search	4. Word bubble/word graph
5. Special strings and keywords for advanced search	5. 3D graph of connected topics (VR/AR tech needed)
Combined implementation	
Chatbot (existing tech) based search – the chatbot first asks about the category of search first and then the search query. Top 3 results by relevance are returned and chatbot continues to iterate and refine in case user is not satisfied with search results	
Advanced NLP based conversational interface (NOT a chatbot) – capable of having general intelligent conversation in natural language factoring in user context (think ~ 2001 a space odyssey)	
Additional input/output methods	
Language Translation. Voice input	Language Translation, Voice input

3 SELECTION CRITERIA

Requirements (from Assignment M2):

1. The search bar should be dynamic
2. The search bar should not force users to pre-select categories before being able to search through them.
3. Search bar should be able to process natural language queries – in the user's own language
4. Information returned via the search function should be rich and comprehensive. Search should return relevant information across multiple categories: Investment education, Market information, Portfolio review, User account management

Additional Requirements

1. The ideas should be implementable with current commercially available technology – As the design is for a small feature of a larger website, it will not be justified to have high cost and long development time

Based on the above criteria, following three ideas have been selected for prototyping. All of them meet the additional requirement of technological feasibility, and majority of the requirements from Assignment M2

Ideas Selected for Prototyping

1. Dynamic search bar – the search suggestions will be categorized, search results will be shown in 2D grid (Topic vs Search Results)
2. Dynamic search bar – the search will feature special strings and keywords for advanced search/power users, search results will be shown in 2D grid (Topic vs Search Results)
3. Chatbot based search (search input and output in common interface)

4 PROTOTYPE 1

Dynamic search bar – the search suggestions will be categorized, results will be shown in 2D grid (Topic vs Search Results)

4.1 Paper Prototype

Figure 1 shows the paper prototype for design 1 (search input and search output respectively) for the search input screen. The paper prototype of search output screen is given in appendix 2

The search box is dynamic, and the interface displays most relevant search results across different categories that match the search string. Users can directly click on these if that is what they are looking for. There is an option at the bottom for do a free text search for the search string

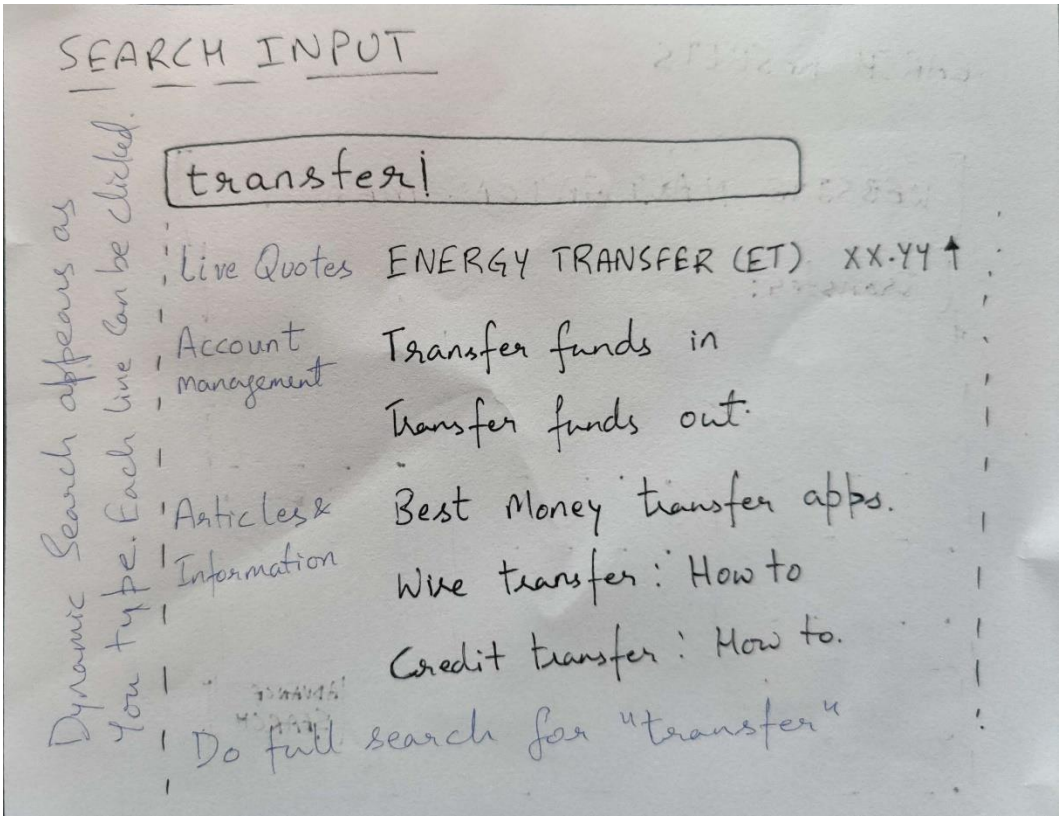


Figure 1 — Paper prototype for search input screen – search query is "transfer" (full interface with search input and output screen is given in appendix 2).

The search results are displayed in a 2D grid – categories that are relevant to the search query are arranged horizontally and top results (maximum 3) for each of these categories are arranged vertically. The section below this lists results for the search query across all categories, arranged by relevance

4.2 Evaluation

The requirements met by the prototype (Assignment M2): Search bar should be dynamic, Should not force users to pre-select categories before being able to search through them, The search function should be able to lead to relevant information across multiple categories: Investment education, Market information, Portfolio review, User account management (results displayed in 2D grid across categories)

Requirements not met/further testing needed: The information returned via the search function should be rich and comprehensive – While the search results returned are comprehensive, this requirement will be better assessed via user feedback

Prototype suitability to audience: As described in Assignment M2 "users are predominantly middle aged or older and tend to be well educated (usually at least an undergraduate degree)" and "The users who do use the websites tend to be highly engaged". The user group is well suited to take in the information (high education and high engagement level)

Overall, this prototype meets most of the requirements. The display of search results in 2D grid, while giving comprehensive information, is not common on the internet, so user feedback will be needed on its usefulness

5 PROTOTYPE 2

Dynamic search bar – the search will feature special strings and keywords for advanced search/power users, results will be shown in 2D grid (Topic vs Search Results)

5.1 Verbal Prototype

This section describes the search interface for an investment website. The interface is divided in two components for ease of explanation: Search Input and Search Output:

1. Search Input:
    a. This is a standard search bar that accepts text-based search queries
    b. The search input is dynamic – the interface lists search suggestions below the search bar as the user types the search query

c. The search input accepts special characters and keywords to build custom advanced search query within the search box
d. These characters and keywords follow the format of Google's search operators[1] – this maintains consistency and helps discoverability. For example:
    i. To exclude a specific work "Put - in front of a word you want to leave out. For example, jaguar speed -car"
    ii. For an exact match "Put a word or phrase inside quotes. For example, "tallest building""
    iii. Use "OR" "AND" to combine search queries
    iv. Use "filetype:" to search only in a specific type of file
e. To help in discoverability, the dynamic search interface lists related queries to the search as the user types. For example when user types "video streaming", the dynamic search bar displays the following below the search query:
    i. Search for videos on *streaming* (contentType:Video)
    ii. Search for *video streaming* stocks (contentType:Stocks)
    iii. Search for *video streaming* in articles (contentType:Atricles)
    iv. Search for *video streaming* in articles only in article title (contentType:Atricles and searchType:Title)
    v. Search for exact phrase *video streaming* "video streaming"
    vi. Search for all results for *video streaming*

2. Search Output:
    a. If the user selects a specific content type, then search output is a flat list of results from that category
    b. If the user searches for all results, the search output is a 2D grid with content categories arranged horizontally and search results arranged vertically

5.2 Evaluation

The requirements met by the prototype are same as prototype 1: Search bar should be dynamic, should not force users to pre-select categories before being able to search through them and the search function should be able to lead to relevant information across multiple categories:

[1] https://support.google.com/websearch/answer/2466433?hl=en

Requirements not met/further testing needed: The information returned via the search function should be rich and comprehensive – While the search results returned are comprehensive, this requirement will be better assessed via user feedback

Prototype suitability to audience: As described in Assignment M2 "users are predominantly middle aged or older and tend to be well educated (usually at least an undergraduate degree)" and "The users who do use the websites tend to be highly engaged". Although the search interface is slightly complicated and gives a lot of information, the user group is well suited to take in the information (high education and high engagement level)

Overall, the prototype meets most of the requirements, but the interface might be overly complicated even for expert users. This is something that will need to be evaluated via further user feedback

6 PROTOTYPE 3 – CHATBOT SEARCH

6.1 Card Prototype

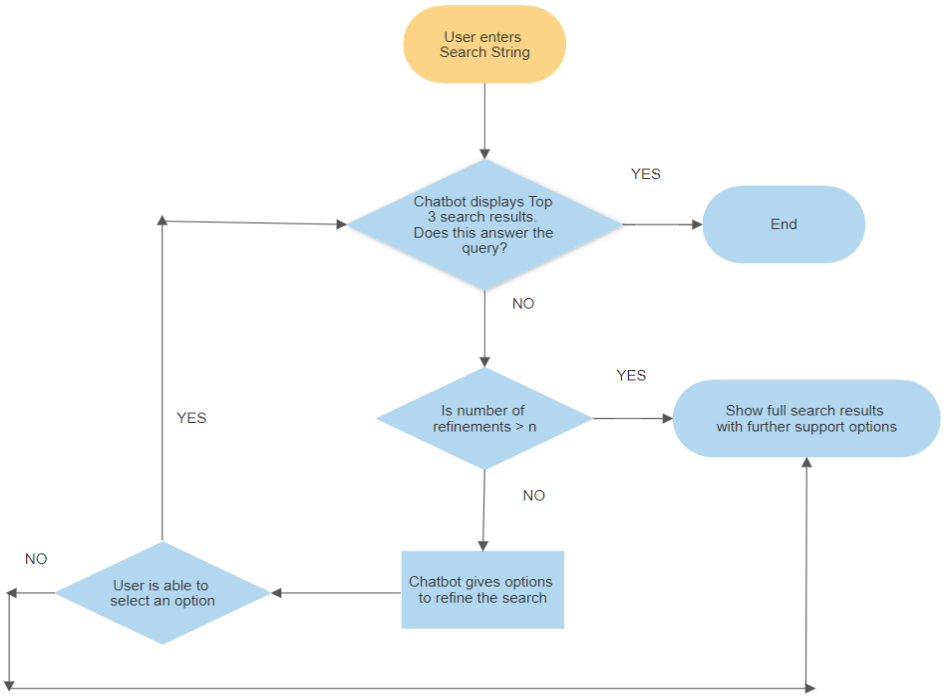


Figure 2 — Flowchart of Chatbot interaction, detailed screens are given in Appendix 3

Figure 2 shows the flow chart of the chatbot search. The cards/screens for the prototype are given in appendix 3

The chatbot takes the user through the 3 most relevant search results at a time, iteratively refining the results based on user input if user is not satisfied. After a predetermined number of refinements the chatbot displays full search results.

6.2 Evaluation

The requirements met by the prototype: The search function should be able to lead to relevant information across multiple categories, The search bar should be able to process natural language queries and not force users to pre-select categories before being able to search through them

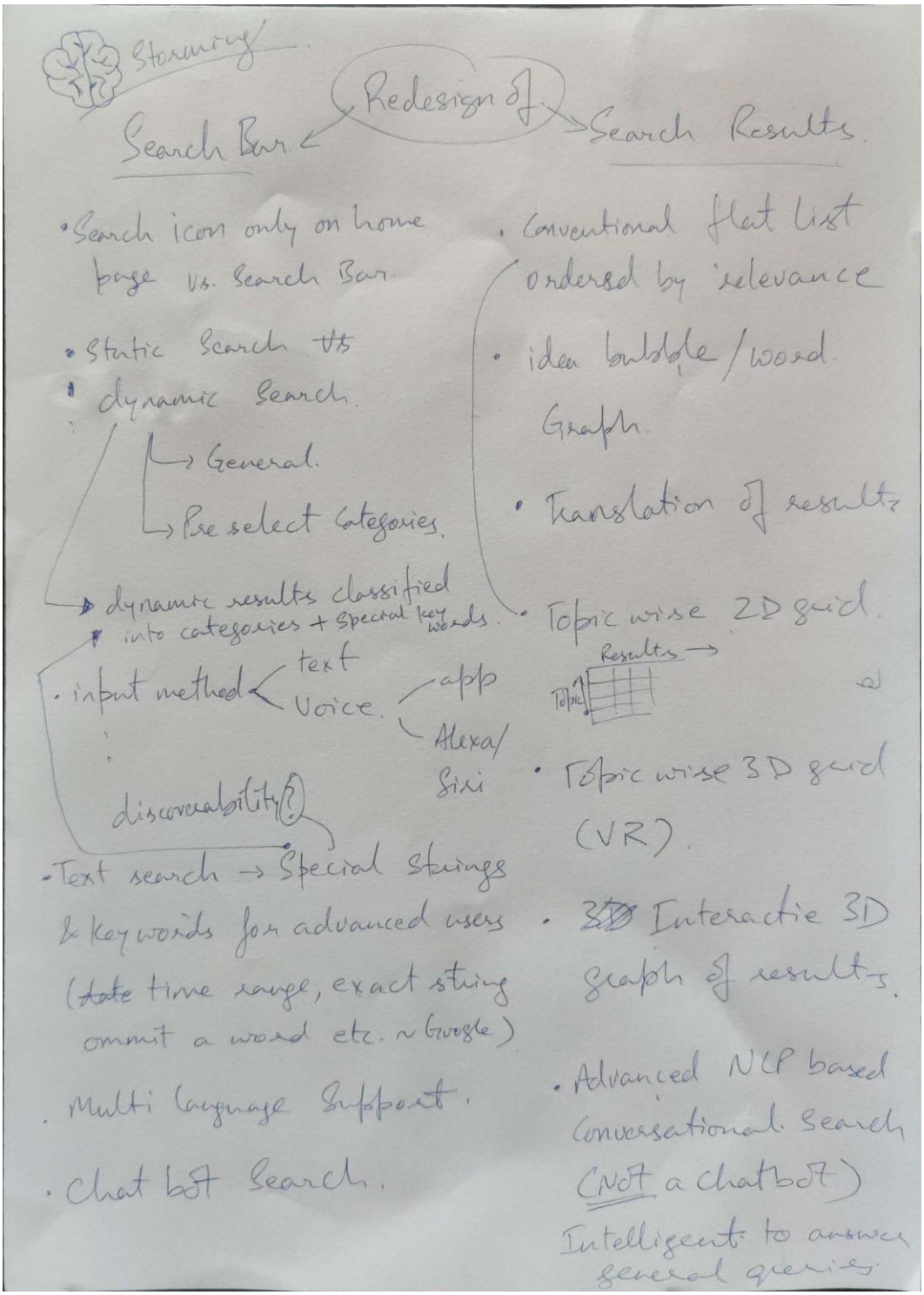
The requirements not met by the prototype: information returned via the search function should be rich and comprehensive

Prototype suitability to audience: The chatbot interface is intuitive to use and can respond to natural language queries. The user group will be able to use this

Overall, this prototype seems more user friendly in terms of being able to process natural language queries, but the constrained amount of information displayed at each step might not suit the expert users. This interface can however be useful to *potential* novice users of investment websites, who don't use one now due to the complicated and overwhelming amount of information available

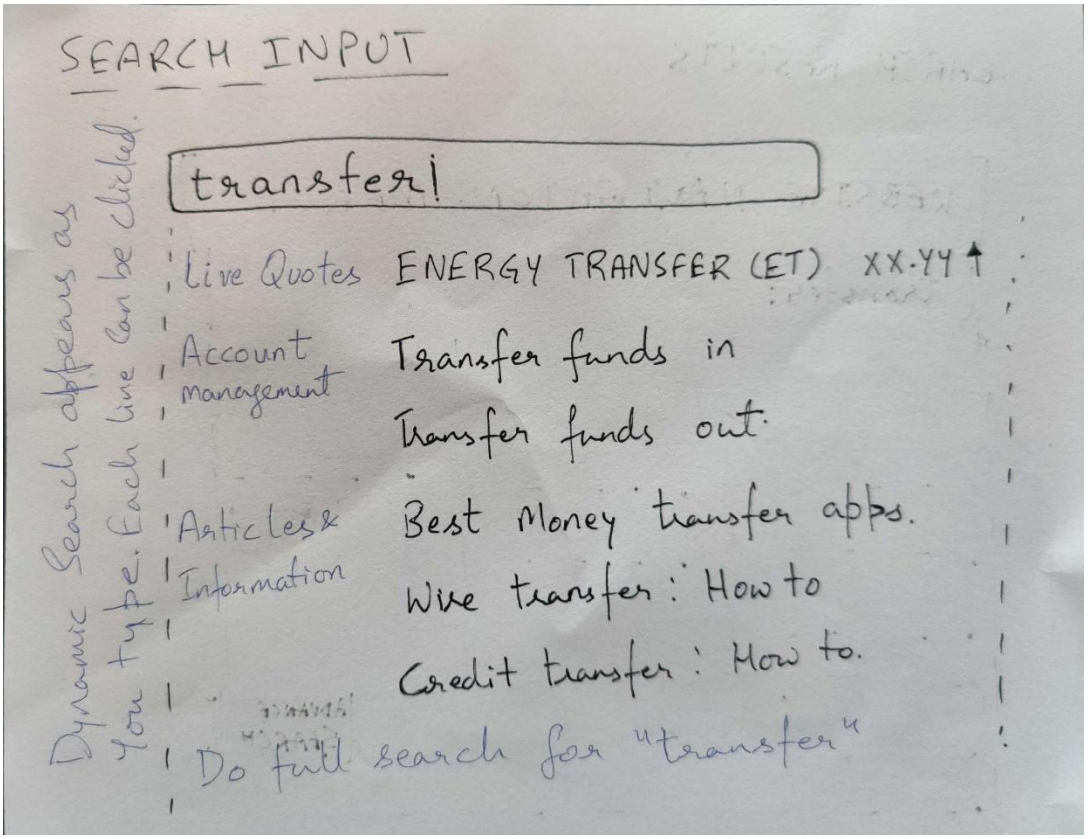
7 APPENDICES

7.1 Appendix 1 – Brainstorming Sheet

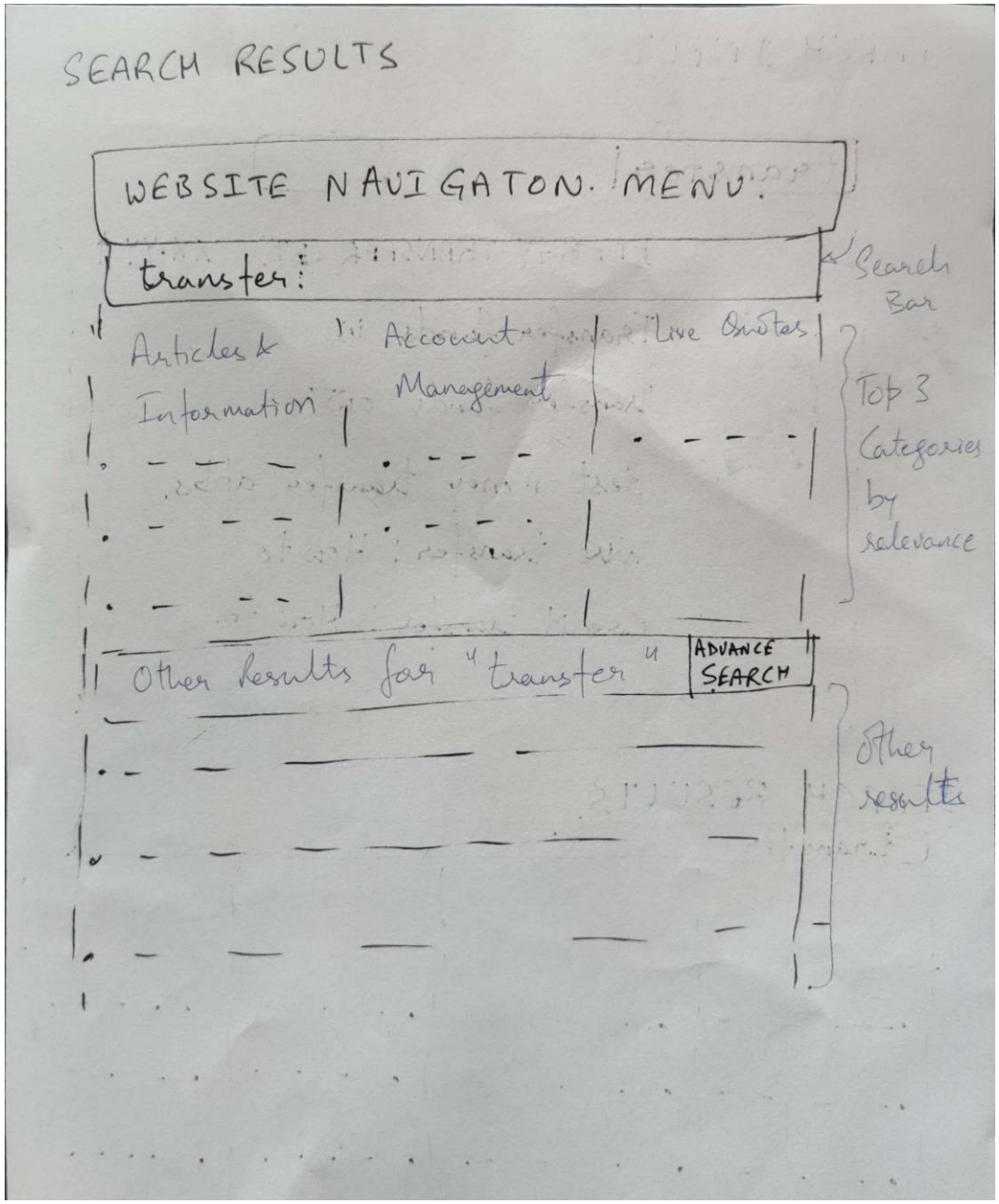


7.2 Appendix 2 – Paper Prototype

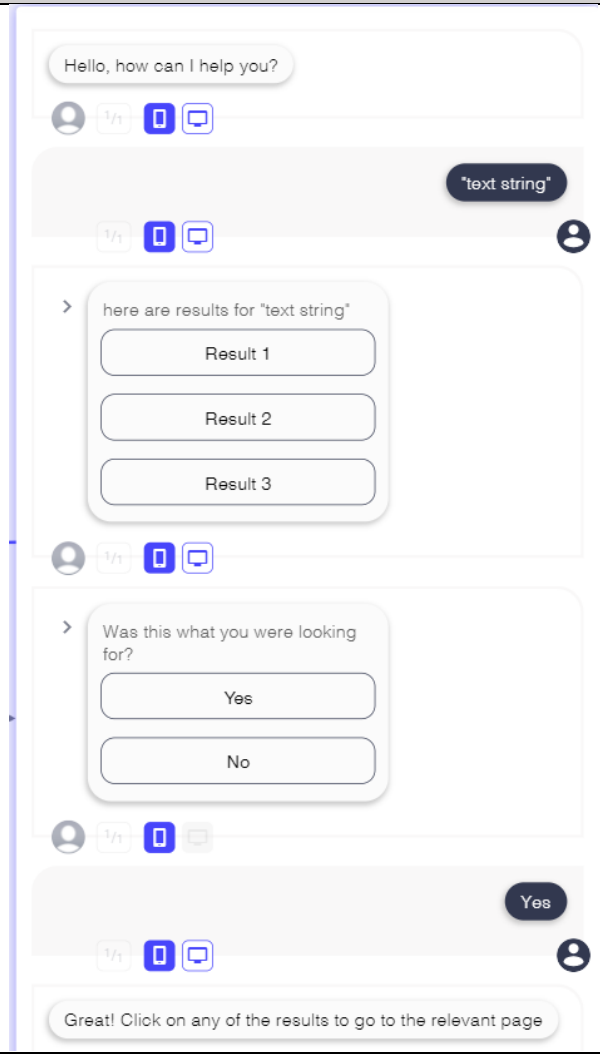
1. SEARCH INPUT SCREEN

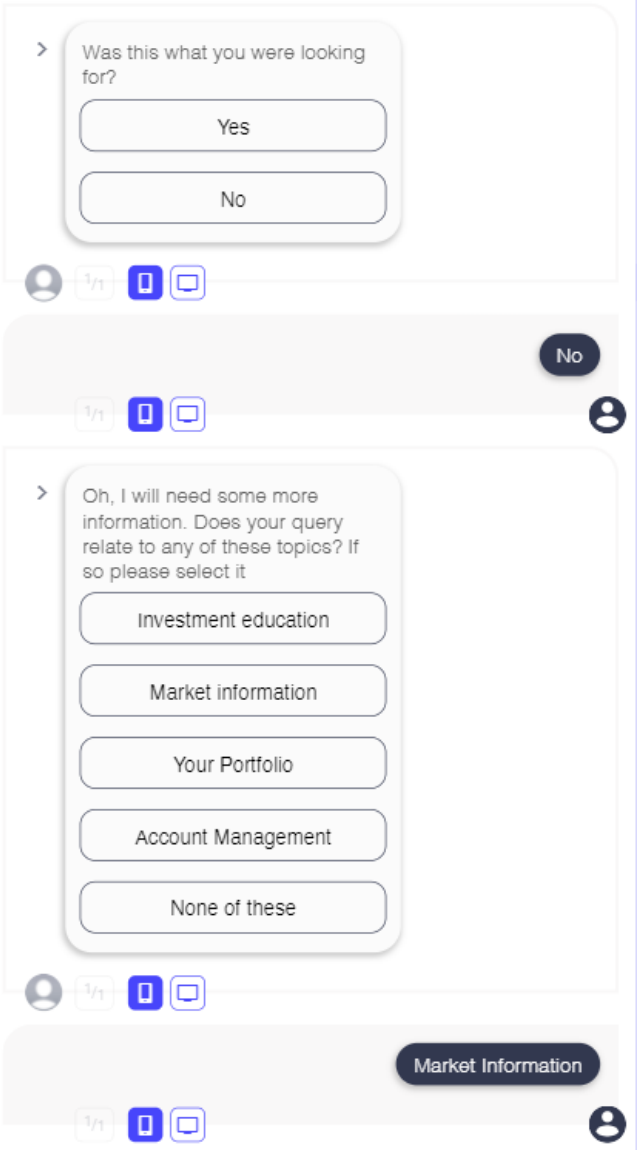
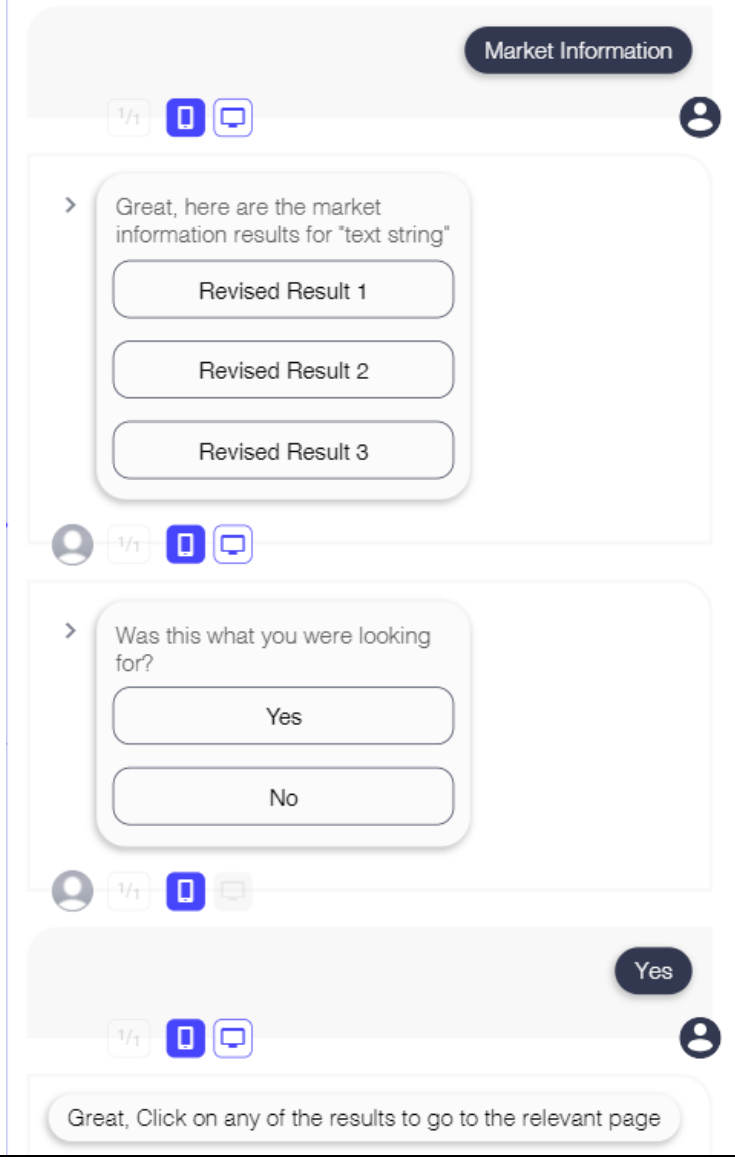


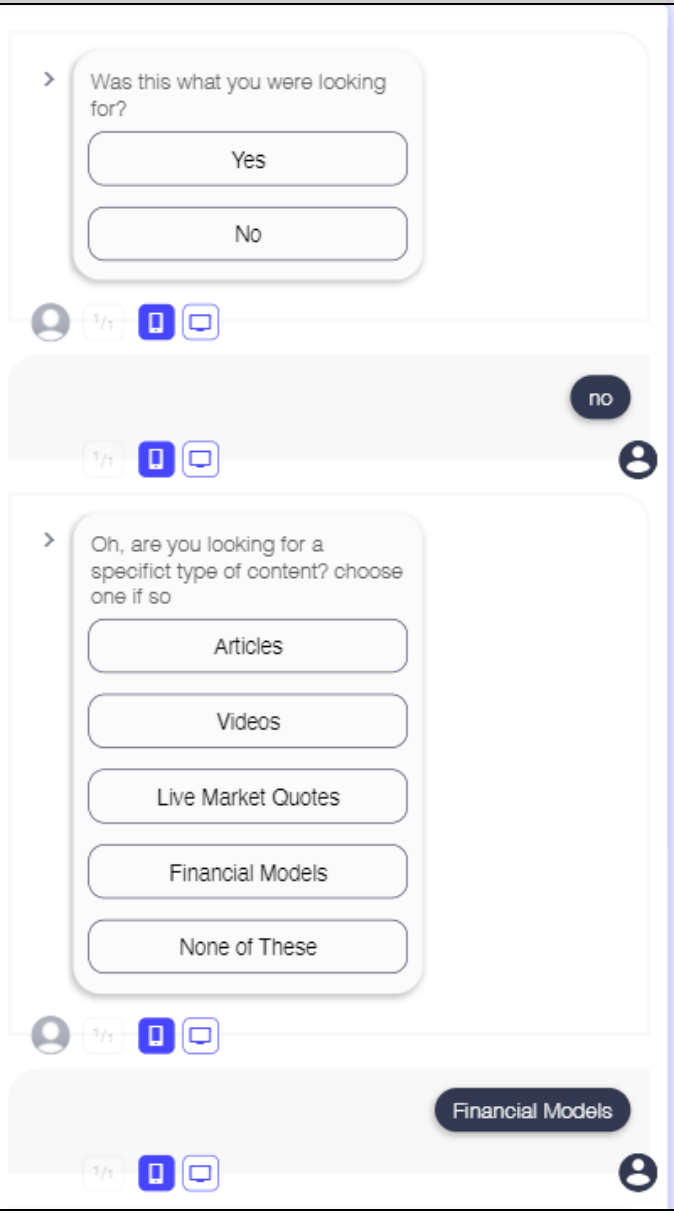
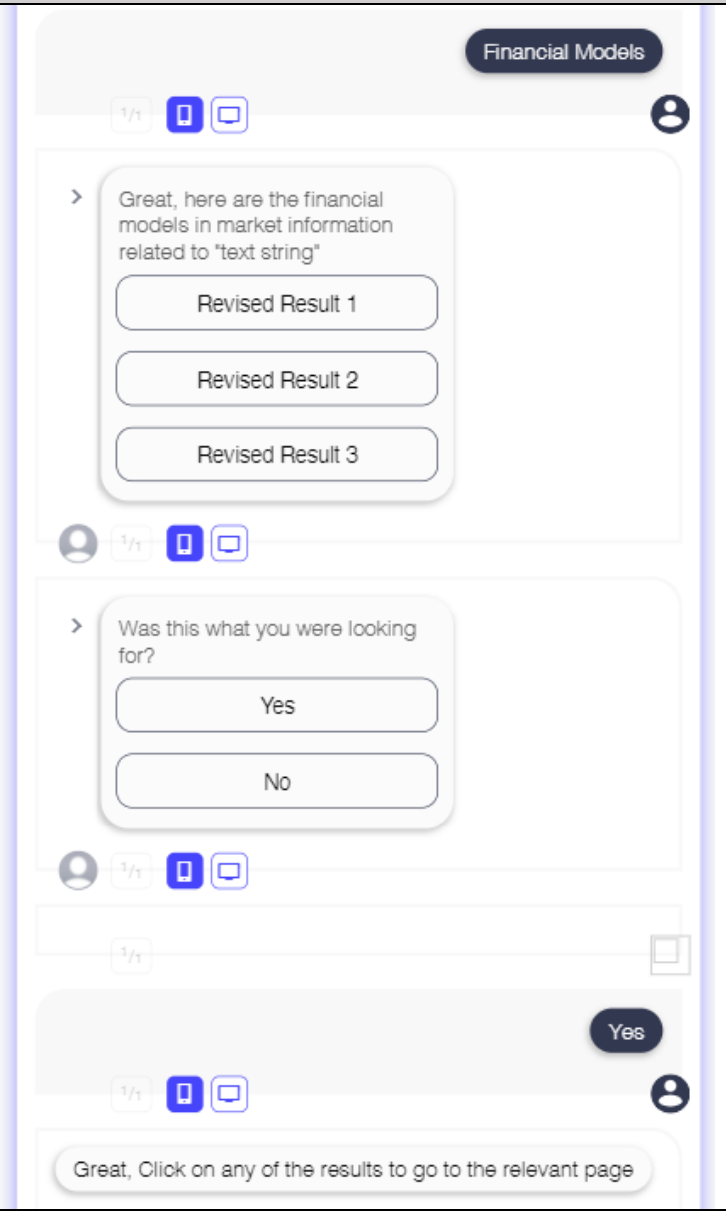
2. SEARCH RESULTS OUTPUT SCREEN

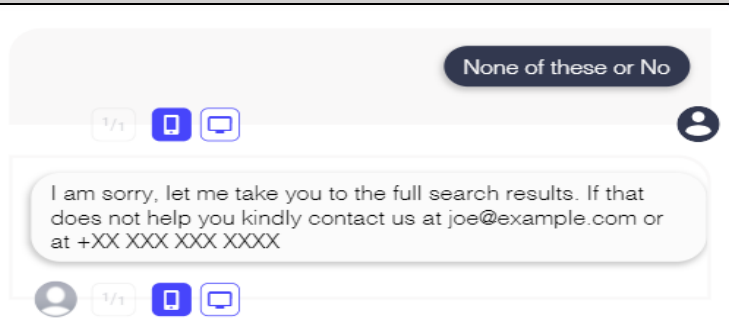
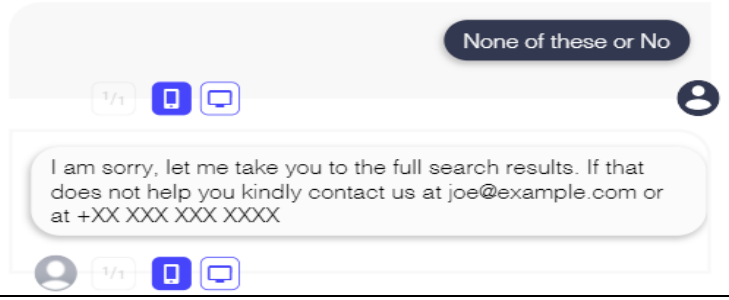


7.3 Appendix 3 – Card based prototype Interactions resulting from a "yes" answer is given first followed by interaction resulting from a "no" answer

Step #	Screen	Screen
A		

Step #	Screen	Screen
B		

Step #	Screen	Screen
C		

Step #	Screen	Screen
D	User Chooses **"None of these"** in Steps B & C	
E	User Chooses **"No"** in Step C	

Chatbot prototypes created on: https://app.botsociety.io/