An Huynh

Introducing Power Search to Frosmo's Control Panel

Metropolia University of Applied Sciences
Bachelor of Engineering
Information Technology
Bachelor's Thesis
15 February 2023

Abstract

Author: An Huynh

Title:	Introducing new features and improvements to the Frosmo Control Panel Dashboard
Number of Pages:	47 pages + 1 appendix
Date:	15 February 2023
Degree:	Bachelor of Engineering
Degree Programme:	Information Technology
Instructor:	Ilkka Kylmäniemi

Abstract:

The purpose of this study was to find out how the Frosmo Power Search can be developed so that the company can bring more offers to its existing customers and attract new ones.

The first phase of this project was to design the user interface. During the second phase, UX/UI mockups were created and user experience tests were carried out. Finally, the implementation and development phase was done in several epics and tasks, subtasks whereas developers took the responsibility for each small ticket task.

As a result of this study, the Frosmo Power Search was developed. It will help Frosmo’s employees to keep track of the customers' sites search performance and act as power users to provide assistance to customers in need. Moreover, it will be easier for Frosmo’s customers and external users to monitor and adjust their business strategy according to the search statistics report. As a result, it will provide users with a more efficient, flexible, and insightful search on their sites and applications.

Keywords: design, new feature, dashboard, platform improvements

Contents

List of Abbreviations 6

1 Introduction 1

2 Company background 2

2.1 Who are the company's target customers? 2

2.2 Frosmo Platform 2

2.3 Frosmo Control Panel 3

3 Project planning and methods 5

3.1 Agile methodology 5

3.1.1 Agile with scrum 6

3.1.2 Scrum team 6

3.1.3 Sprint planning 9

3.2 Scrum practice in the development team 10

3.3.1 Kanban board 10

3.3.2 Daily standup 12

3.3.3 Sprint retrospective 13

4 Frosmo Search 13

4.1 Instant search 13

4.1.1 What is instant search and why is it important? 13

4.1.2 Frosmo search idealization 14

4.2 Frosmo Search breakdown 14

4.2.1 Search engine 15

4.2.2 Instant Search suggestion box 16

4.2.3 Search API 16

4.3 User interface design 17

4.3.1 The importance of user interface design 17

4.3.2 Search user interface design 17

4.4 User Experience 20

4.4.1 The importance of user experience 20

4.4.2 User research method 21
4.4.2 Interview process 21
4.4 Technical Planning 22
4.4.1 Feature requirements 22
4.4.2 API requirements 23
4.4.3 Integrating Search to customers' sites 23
5 Development phase 24
5.1 Search Parameters and response 24
5.1.1 Search Parameters 24
5.1.2 Search Response (figure 12) 25
5.2 Search Statistics 26
5.2.1 Search statistics view 26
5.2.2 Statistics metrics explanation 26
5.3 Synonym searching 28
5.3.1 What is synonyms searching? 28
5.3.2 Frosmo supported synonyms types 28
5.4 Boost and bury rules in search results 30
5.4.1 Frosmo Search product's boost and weight fields? 30
5.4.2 The difference between attribute level boosting and product level boosting 31
5.4.3 Boosted item settings and user interface 32
5.5 Target attributes boosting rules 32
5.1.2 Searchable attributes 32
5.5.2 Configure attributes rules 33
5.6 Results 34
6 Conclusion 34
References 36
Appendices
Appendix 1: User test

List of Abbreviations

API: Application programming interface. It is a way for two or more computer programs to communicate with each other. It is a type of software interface, offering a service to other pieces of software and updating data and metadata in a database.

FCP: Frosmo Control Panel. Frosmo’s user interface admin control dashboard allows users to have full control of what happens on their sites behind the scenes.

JS: Javascript programming language.

1 Introduction

The main objective of this thesis is to introduce a new Search feature that serves as an add-on to the existing main product through the process of designing, planning and implementing for Frosmo Oy - a software-as-a-service company, it will also analyze, go through each functionality belongs to the Search add-on and include some technical explanations.

The existing demand is based on the fact that the company has been in the industry for more than a decade. At the moment, there is a surging need for it to establish, introduce a new feature to attract new customers and keep the current ones happy as well as increase the customer loyalty (The importance of search engine in e-commerce, 2021). All in all, a new feature will be a win-win solution to both the company itself in terms of increasing revenue and its customers in terms of keeping them satisfied and curious about the company product. As long as the satisfaction rate is maintained, the customers are willing to pay more for an additional service the company offers (Iakovliev, I., 2022)

Now that most of the company's customers are in the retail industry, when it comes to online shopping services, search engines are playing a key role in manipulating the search results (Kooser, A., n.d.). In this case, no matter if it is products or pages, one site would want its visitors to see and get the best experience to boost the sales and so on. Another advantage of the new feature is that it can help the websites to dig into what their visitors search and if it returns no results, they can change that behavior and give product suggestions based on what the users enter (Site Search, n.d.). Therefore, having this add-on introduced would give the company's clients a powerful tool to help strengthen their business strategies and operation.

This thesis consists of a theoretical part, which gives a walkthrough of the company background and its customers, as well as the methodology used in

implementing the product, and a technical part where the additional feature is put into the table for analyzing, explaining the details and how it works.

The inspiration for the thesis was found from the author's work as part of this project as a UX/UI designer and interests on improving the user experience and user interface of the company's offering at this moment. The project includes lots of work related to designing, doing user research and technical implementation. As a result, the new feature will enable the company to satisfy its customers and moreover to meet the customers' expectations to maintain its service rating.

2 Company background

Frosmo is a software company that provides its customers with a platform to help them become successful in digital services by making personalization fast and easy.

2.1 Who are the company's target customers?

Currently, Frosmo is focusing its market in two sectors: e-commerce (retail) and i-gaming websites companies that are located around the globe. Frosmo service is available in these regions: the US, Asia, and Europe.

2.2 Frosmo Platform

The platform essentially performs two tasks on a website:

- Enhance the visitor's user experience. For example, the platform can introduce a recommendation to the site's home page to improve visitor engagement and retention and to drive visitors toward a conversion. These changes to the site are known as modifications.

- Track the visitor's behavior across the user journey. This tracking produces data that the platform uses to (a) implement features that enhance the visitor's user experience in some way and (b) generate reports for analytics purposes. For example, the platform can track visitor transactions on the site, which in turn allows the platform to (a) display recommendations based on most bought items and (b) generate revenue performance reports.

The platform consists of the following main components:

- Frosmo JavaScript library is the Frosmo presence in the front end. The library handles all modifications to the site, manages segmentation, collects usage data, and fetches content to display from the back end.
- Frosmo back end stores the usage data collected by the Frosmo JavaScript library and processes the data for reporting and analytics purposes. The back end also stores operational data related to modifications, segments, and other configurable features. Finally, the back end provides public APIs that allow the Frosmo JavaScript library to interact with the back end, and developers to use the platform and its features from their own applications.
- Frosmo Control Panel is the main user interface of the platform. It is used to customize customers' sites and monitor their performance. The Control Panel manages the Frosmo JavaScript library and pools analytics data from the Frosmo back end.

2.3 Frosmo Control Panel

The Frosmo Control Panel is the main user interface of the Frosmo Platform. It is used to customize customers' websites and monitor their performance.

In a nutshell, the Control Panel allows users to:

- Configure how and for whom the platform modifies the content and user experience of a site.
- Configure how the platform segments visitors on a site.
- Monitor how well the modifications and segmentation perform on a site.

- Create and manage user accounts for their company or organization.

Under the hood, the Control Panel manages the Frosmo JavaScript library. Changes made to a site in the Control Panel are automatically reflected in the custom script for that site.

2.4 Introduction to new feature - Frosmo Search

Frosmo Search (or simply "search") is a search engine and a suite of search tools for sites that run the Frosmo Platform. Frosmo Search allows its clients' companies to set up a site search from scratch or replace their existing site search solution.

Frosmo Search consists of the following key components:

- Search engine. Makes use of the TypeSense Open-source-based search engine that delivers fast, typo-tolerant search and discovery experiences to visitors (API Reference, 2022). A few key features of Typesense are:
    - Simple and Delightful: Simple to set up, integrate with, operate, and scale.
    - Tunable Ranking: Easy to tailor your search results to perfection. Sorting: Sort results based on a particular field at query time (helpful for features like "Sort by Price").
    - Faceting & Filtering: Drill down and refine results.
    - Grouping & Distinct: Group similar results together to show more variety.
    - Typo-tolerant: handle typographical errors.
- Search management. Configure, test, and monitor how the search works for visitors on the site. The Frosmo Control Panel provides a dedicated management UI for the search.
- Instant Search. Ready-made search box UI element for the site. The search box delivers an instant, search-as-you-type experience complemented by personalized recommendations and category suggestions.

- Search API. Public API for running searches and retrieving the search results. You can use the API to build the search results page and listing pages.

Frosmo Search implements a site search and there are a few reasons why the customers should put this feature into use. The needs for Frosmo Search depend on the current site search solution:

- No site search. If the customer's site does not have an existing search functionality in place, Frosmo Search provides a robust, ready-made solution that is integrated with the Frosmo Platform.
- Traditional site search. If the customer's site has an existing search solution, but the solution does not meet their needs, Frosmo Search offers a modern replacement based on cutting-edge technologies with advanced customization options and built-in support for Frosmo Platform features, such as data tracking and recommendations. However, to keep the search experience consistent across the site, it is recommended that the Frosmo Search will fully replace the existing site search. For example, use Frosmo Search both for the site search box and the search results page, so that the end users get matching results in both.
- Instant Search. Replace a traditional search box, which returns results only after users have entered the full search term, with a modern search-as-you-type search box, which returns results instantly and dynamically as typing in the search term.

3 Project planning and methods

When it comes to project management, there are many different approaches, methodologies, and frameworks that can be used to achieve the project objectives (Scott, E., 2022). Frosmo applies one of the most widely used project management philosophies - Agile methodology for its flexibility, adaptability to change, and high level of customer input (What is agile methodology in Project Management?, n.d.).

3.1 Agile methodology

The process of managing projects at Frosmo requires constant collaboration and working in iterations. And with Agile methodology, the teams are provided a basis that can be continuously improved upon throughout a project cycle, with all the changes and decisions made quickly and responsively.

When a project management methodology is Agile, it refers to an umbrella term that consists of many different frameworks and terms such as Scrum, Kanban, Adaptive Project Framework, or Extreme Programming (West, n.d.).

An agile team unites under a shared vision, then brings it to life the way they know is best (West, n.d.).
Each team sets its own standards for quality, usability, and completeness. Their "definition of done" then informs how fast they'll churn the workout. Although it can be scary at first, company leaders find that when they put their trust in an agile team, that team feels a greater sense of ownership and rises to meet (or exceed) management's expectations (Stevens, E., 2019).

3.1.1 Agile with scrum

Scrum framework is applied to help the development team at Frosmo with project management (What is agile methodology in Project Management?, no date). The methodology encourages team members to learn through experiences, self-organize while working together, reflect on their wins and losses and continue to improve (Schwaber, K. and Beedle, M., 2002, p.55).

Scrum is used when a development project is being initiated. All the things that the project should include and address all functionality, features and technology in the Product Backlog. The product backlog prioritizes the list of all product requirements, it emerges and evolves along with the product and new requirements keep being discussed and added to the list. Items which are also

known as tickets in this project are listed from high to low based on the priority of desire (Fürnkranz, 2013).

3.1.2 Scrum team

The scrum team consists of five members, are cross-functional, meaning the members have all the skills necessary to create value each Sprint. They are also self-managing, meaning they internally decide who does what, when, and how, creating the team dynamics (West, n.d.). The Scrum Team is responsible for all product-related activities from stakeholder collaboration, verification, maintenance, operation, experimentation, research and development, and anything else that might be required. They are structured and empowered by the organization to manage their own work. Working in Sprints at a sustainable pace improves the Scrum Team's focus and consistency.

- The Product Owner is responsible for maximizing the value of the product resulting from the work of the Scrum Team. The Product Owner is also accountable for effective Product Backlog management, which includes:
- Developing and explicitly communicating the Product Goal.
- Creating and clearly communicating Product Backlog items.
- Ordering Product Backlog items
- Ensuring that the Product Backlog is transparent, visible and understood.

The Product Owner may do the above work or may delegate the responsibility to others. Regardless, the Product Owner remains accountable.

In the Frosmo development team, the product owner manages and prioritizes the product backlogs for the upcoming Sprint. He also translates the strategies delivered by the Management board to the team members and breaks them down into stories or executable tasks for actions and works with the developers to implement them. In the scrum team, the product owner is the one who most understands the customers' needs as he continues to learn about what problems the company is aiming to solve with Frosmo's offering by those stories' tasks defined above. The team product owner is also flexibly approachable to development and answering questions as any team member may have while they are working with stories or any other tasks.

- The Scrum Master makes sure the team improves its practices within the Scrum framework.

The Scrum Master serves the Scrum Team in several ways, including:

- Coaching the team members in self-management and cross-functionality.
- Helping the Scrum Team focus on creating high-value Increments that meet the definition of done.
- Causing the removal of impediments to the Scrum Team's progress.
- Ensuring that all Scrum events take place and are positive, productive, and kept within the timebox.

In the Frosmo development team, the Scrum Master serves the Product Owner in several ways, including:

- Helping find techniques for effective Product Goal definition and Product Backlog management.
- Helping the Scrum Team understand the need for clear and concise Product Backlog items.
- Helping establish empirical product planning for a complex environment.
- Facilitating stakeholder collaboration as requested or needed.

The Scrum Master belongs to the Frosmo product team and serves the company, provides support when it comes to applying the scrum methodology in the organization, including:

- Leading, training, and coaching the organization in its Scrum adoption.
- Keeping the teams organized, on track and focused on the current matters.
- Planning and advising Scrum implementations within the organization.
- Helping employees and stakeholders understand and enact an empirical approach for complex work.

- Removing barriers between stakeholders and Scrum Teams.

- The team has two product developers who are responsible for implementing backend and database service as well as maintaining the platform by releasing performance and error reports improvements every week. They also keep a close eye on the support request where the other company employees will report any errors or bugs they found while interacting with the Frosmo Control Panel.
- Developers: Developers are the people in the Scrum Team that are committed to creating any aspect of a usable increment each Sprint and are always accountable for:
    - Creating a plan for the Sprint, the Sprint Backlog.
    - Instilling quality by adhering to a Definition of Done.
    - Adapting their plan each day toward the Sprint Goal.
    - Holding each other accountable as professionals.

The Frosmo Product team has two web developers who are responsible for building the user interface and fetching data from the backend or API service and displaying them in the Frosmo Control Panel. They are in charge of following the Frosmo Style guide and ensure that all the elements implemented will match the Frosmo predefined design system. They also will ensure the logic is implemented in the React library.

3.1.3 Sprint planning

The team members meet with the scrum master and product owner to plan each sprint. The sprint meetings consist of two consecutive meetings. In the first meeting, all team members meet with the Product Owner, Scrum Master, and users to figure out what functionality to build during the next sprint. The second meeting is held among the team members to figure out how this functionality will be implemented during the sprint. As a result, the team adds more inputs to the Product Backlog to meet the sprint goal. These inputs are the tickets/tasks that are pieces of work needed to convert the product backlog into a working product. Each task should have enough detail so that it will take about a day or two to complete. And the task list is called a “Sprint Backlog” and it is modified

throughout the sprint as when it gets into individual tasks, the team may find out that more or fewer tasks are needed. During the Sprint:

- No changes are made that would endanger the Sprint Goal.
- Quality does not decrease.
- The Product Backlog is refined as needed.
- Scope may be clarified and renegotiated with the Product Owner as more is learned.

Sprints enable predictability by ensuring inspection and adaptation of progress toward a Product Goal at least every calendar month. When a Sprint's horizon is too long the Sprint Goal may become invalid, complexity may rise, and risk may increase. Shorter Sprints can be employed to generate more learning cycles and limit risk of cost and effort to a smaller time frame. Each Sprint may be considered a short project (What is agile methodology in Project Management?, n.d.).

3.2 Scrum practice in the development team

In order to ensure the team process and the practices of scrum methodology, the product development team uses Jira software that includes a Kanban board, ticket system, task management to help visualize the distribution of tasks, limit work-in-progress and maximize team efficiency. It helps the team to move forward and establish order in their daily work. Kanban boards use cards, tickets, columns and continuous improvement to help technology and service teams communicate, commit to the amount of workload and get the tasks done.

3.3.1 Kanban board

The Frosmo's Product Kanban board includes five elements:

1. Visual Signals - visual tickets (cards). They are the mostly seen element of the board as the team adds all of the project and work items onto, one per ticket. Each card can include a user story. Once on the board, these tickets help teammates and stakeholders quickly understand what the team is working on (figure 1).

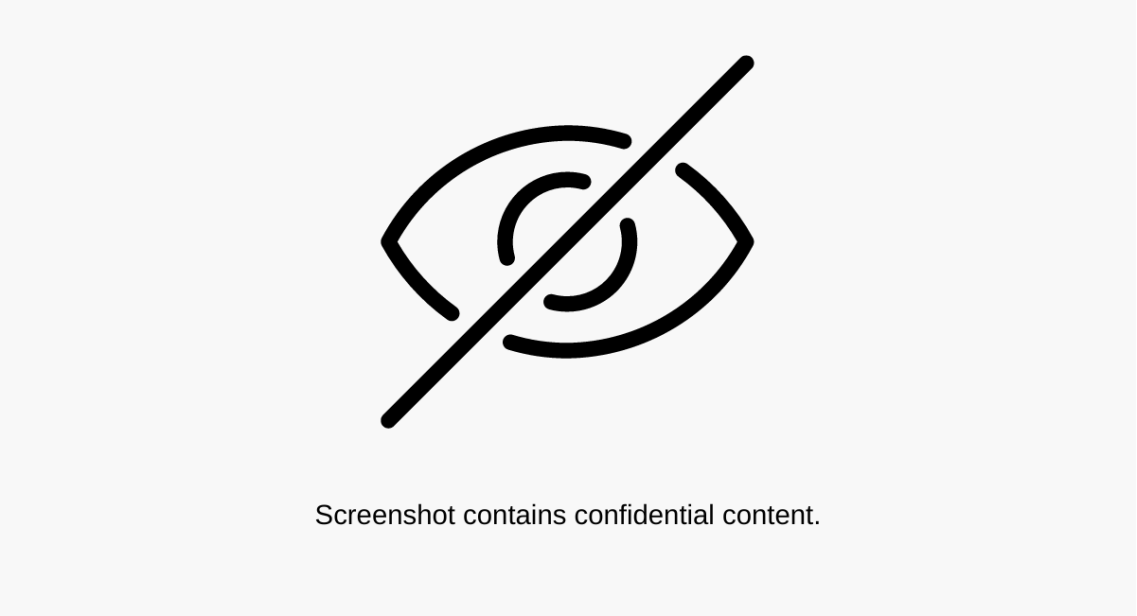


Figure 1. A ticket illustration for a user story.

2. Columns - Each column represents a specific activity that composes a workflow. The created tickets are moved through the workflow until completion (figure 2).

Figure 2. Frosmo's Kanban columns

3. Work in progress limits - the maximum number of a given time. The suggested limit is one in-progress ticket per team member, a new ticket is moved to the column when the previous one is finished. However, it has been agreed in a team that each member has the flexibility to take their tasks and work at their own pace, thus more than one ticket per member at a time is also accepted.
4. Commitment point - the team has a backlog for their board (figure 3). This is where the ideas are added to and the team can pick up when they are ready. The commitment point refers to the moment when an idea is

picked up by the team and work starts on the project.

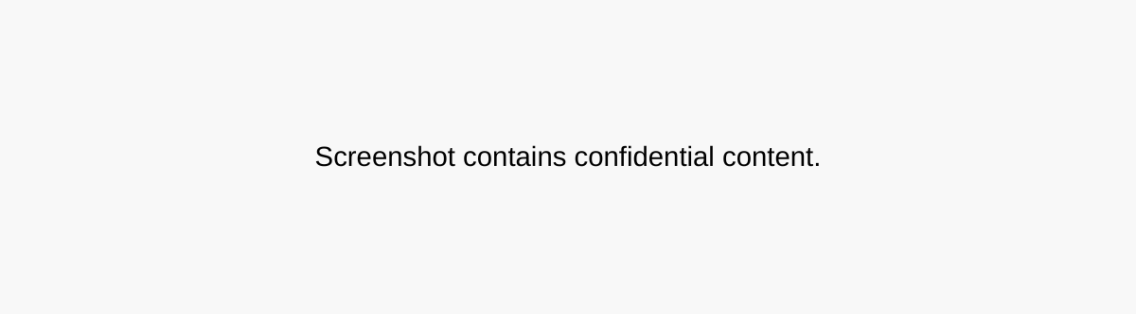


Figure 3. Frosmo's backlog

5. Delivery point - the end of a Kanban workflow. For the Frosmo development team, it is called a "release" (figure 4). When a release is out, the service is readily available in the hands of the customers. The team is continuously improving to decrease their lead time as much as possible.

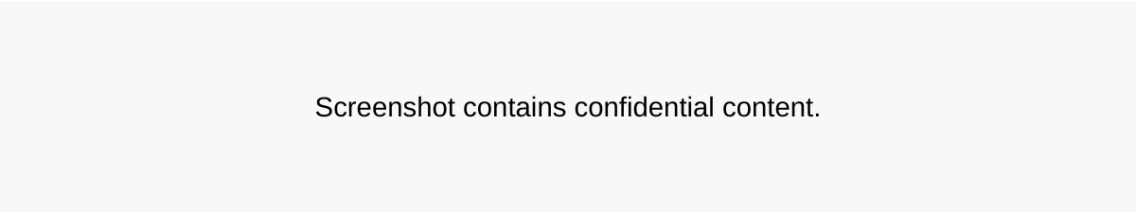


Figure 4. A release example

3.3.2 Daily standup

The scrum team meets daily for a 15-minute status meeting called the Daily Standup (figure 5). During this meeting, each team member explains what he/she has accomplished since the last meeting, what he/she is going to do before the next meeting, and what obstacles are in their way. The daily scrum meeting gets people used to team-based, rapid, intense, co-operative, courteous development. The scrum master is responsible for successfully conducting the daily meeting. He keeps the daily scrum short by enforcing rules and making sure that people speak briefly. The team gets a lot of benefits from the daily meeting in terms of improving communications, eliminating other meetings, identifying, and removing impediments to development, highlighting and promoting quick decision-making, as well as improving everyone's level of project knowledge. And because of the direct and open purpose it serves, attending scrum is easier and more informative than reading a report.

Screenshot contains confidential content.

Figure 5. Daily scrum meetings calendar

3.3.3 Sprint retrospective

Sprint Review is an informal meeting that is organized at the end of the sprint. Similarly, to the sprint planning, management and clients as well as product owners will join the meeting to see if they like what the team has built. The scrum master is responsible for coordinating and conducting the meeting. The scrum master meets with the team and establishes the agenda and discusses how the sprint result will be presented. Then each team member visualizes the demonstrated product functionality working in the user environment. As this is visualized, what functionality should be included in the next sprint is also considered during this meeting. Team members are also encouraged to raise questions, observe, discuss and give suggestions as much as possible. The purpose of this meeting is more about giving and taking information, and not action-oriented.

4 Frosmo Search

4.1 Instant search

4.1.1 What is instant search and why is it important?

The modern online shopper wants to find exactly what he is looking for ... instantly without knowing the exact product description! The average online customer today is tired of scouring category pages in order to find the right product. Therefore, the onsite search in a modern online shop must be fast and intelligent, thus making it easier for shoppers to find the right products. Semantic Instant Search combines the best qualities of an influential onsite search and tailors them to the receptiveness of their customers.

Instant search gives better refinement and scalability. As results are displayed in real-time, customers can add criteria when they find it helpful. For example, looking for a "blue men's T-shirt" may reveal dozens of results that encourage customers to further restrict them to "under 20 $" or "athletic fit". This produces better results, but it also encourages customers to better define their wishes and needs.
Instant search also leads to more conversion rate. When a customer is able to limit a search result in real time, without having to refresh the page or clicking checkboxes to refine the search hits, the product search becomes more convenient and seamless. It follows that the way to the shopping cart as well as the completion of a purchase accelerate. All this translates into more online sales.

4.1.2 Frosmo search idealization

As the company constantly improves and expands its offering to customers, there comes a need of improving the site search by providing relevant, lightning-fast, and typo-tolerant search results complemented by personalized recommendations.
Frosmo Search is a search engine and a suite of search tools for customer sites. Frosmo Search allows you to set up a site search from scratch or replace your existing site search solution. Frosmo aims at providing a variety of tools to help businesses by giving users the possibility to customize product filter options and advance site search functionalities. Many built-in features make it easier to not only implement flexible merchandising strategies and gather insightful analytics on customer behavior and integrate perfectly to the customers' websites.

4.2 Frosmo Search breakdown

Frosmo Search consists of the following key components: Search engine, Instant Search and Search API.

4.2.1 Search engine

The key features of the search engine include:

- Boosting. Make individual items rank higher in search results.
- Broad language support. Frosmo Search supports all modern alphabets.
- Customizable sorting. Select up to three item attributes by which to sort search results. By default, Frosmo Search sorts results primarily by the text match score of each matching item; the higher the score, the more relevant the item, and the higher its rank in the results.
- Customizable targeting. Select which item attributes the search targets, that is, which attributes the search checks for matches. For example, you might have the search target the name, brand, categories, and description attributes of each item.
- Faceting. Enable faceting for an attribute, thereby turning the attribute values into facets that allow visitors to narrow down search results.
- Filtering. Define advanced filtering for refining search results.
- Popularity-based ranking. Frosmo Search uses item popularity for search result tiebreaking when two or more items have the same text match score. The more popular an item, the higher its rank relative to the other tied items. Popularity is based on the number of views and conversions (including transactions) that an item has accumulated.
- Search suggestions. Frosmo Search supports as-you-type autocomplete where the search engine automatically and dynamically suggests complete search terms based on what a visitor is currently typing. For example, if the visitor types in "cam", the search engine might suggest "camera" and "camera lens" as the complete search terms.
- Synonyms. Define search terms that Frosmo Search must treat as equivalent. Searching for one term also returns matches for the others. For example, if visitors typically search for "laptop", but the site uses "notebook" as the common term, defining "laptop" as a synonym for "notebook" allows the search engine to treat notebooks as laptops and thereby match visitor intent with relevant search results (Synonyms, 2019).

- Tunable ranking. Define the relative ranking weights of the attributes that the search targets. An item that has a match in a high-weight attribute is considered more relevant than an item that has a match in a low-weight attribute, and the item with the high-weight attribute is therefore more likely to get a higher rank than the item with the low-weight attribute.
- Typo tolerance. Frosmo Search uses approximate ("fuzzy") string matching to handle typographical errors in search terms. For example, searching for "sirt" automatically matches "shirt" and "skirt" as well.

4.2.2 Instant Search suggestion box

Instant Search is a ready-made search box UI element for sites (Searchable attributes, 2020). The search box allows visitors to use Frosmo Search on a site. The search box delivers an instant, search-as-you-type experience complemented by personalized recommendations and category suggestions.

When a visitor first selects the search box, but before they type anything in, Instant Search displays one or two recommendations as a starting result. When the visitor then starts typing in the search box, Instant Search returns real-time, dynamically updating top results based on the typed search term.

Instant Search is the primary site search interface for Frosmo Search.

If a site already has a search box from an existing site search solution, Instant Search replaces the existing search box, while Frosmo Search replaces the existing search solution. Instant Search can be customized to match the layout and style of the site, including matching the replaced search box so that there's no visual change for visitors.

4.2.3 Search API

The Search API allows you to run searches and retrieve the search results. The API returns the IDs of the items that match the search query (API Reference, 2022).

Use the Search API on a search results page or a listing page to return the IDs of matching items. You can then use the IDs to fetch the relevant item data with which to build the search results for display.

```
# API Request syntax

https://<frosmo_domain>/search?origin=<site_origin>&perPage=<number
_of_products>&q=<search_query>&filter=<filter_query>
```

4.3 User interface design

4.3.1 The importance of user interface design

When people visit a website, their user experience should be considered as the top priority for a retail business in this case. When people have a good experience on the site, the conversion rates are higher, and they tend to tell more people about it. This means more chances to increase sales and even higher opportunities to grow the customer base. This is especially true if you rely on Internet marketing to get in touch with most of one business's target audience (Scott, E., 2022).

People tend to make snap judgments when they visit a site, and want to be able to understand things easily, which is why most physical products can be figured out without digging through a 1,000-page manual. Making your site's UI Design understandable without a manual is the difference between complete success and a potentially discouraging failure.

Simply put, User Interface Design is important because it can make or break the customer base. It creates fewer problems, increases user involvement, perfects functionality and creates a strong link between your customers and your website.

4.3.2 Search user interface design

In the planning phase, the team decided to start the new Search features with four main views in the FCP: Analytics, Synonyms and two Promote products views. Functionality regarding misspelling check and custom search fields will then come in the future. The user interface designs were implemented using the Figma tool.

- Search Analytics: one main view including two separate tables to display the most search terms and search terms that return no result (figure 6).

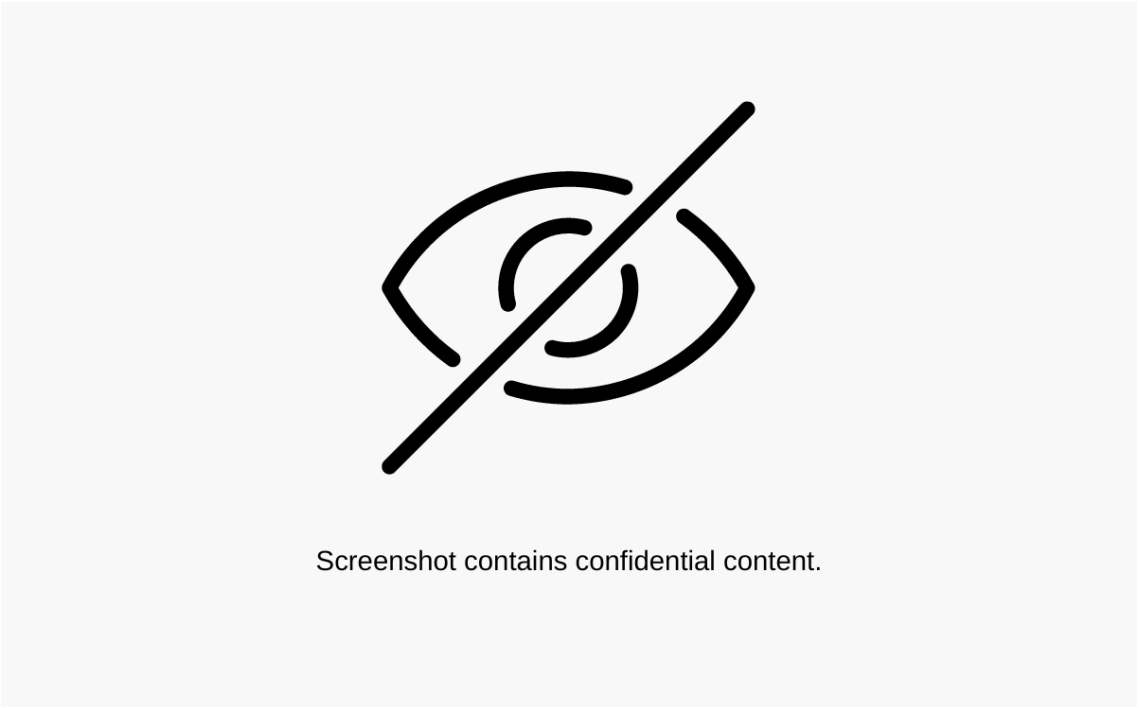


Figure 6. Search Analytics UI design

- Synonyms: this view aims at displaying the options of enable and disable a search term as well as define the direction of the search term regarding whether it is one direct or multi direct. Another sub view for Synonym is Add Synonym view (figure 7 and figure 8).

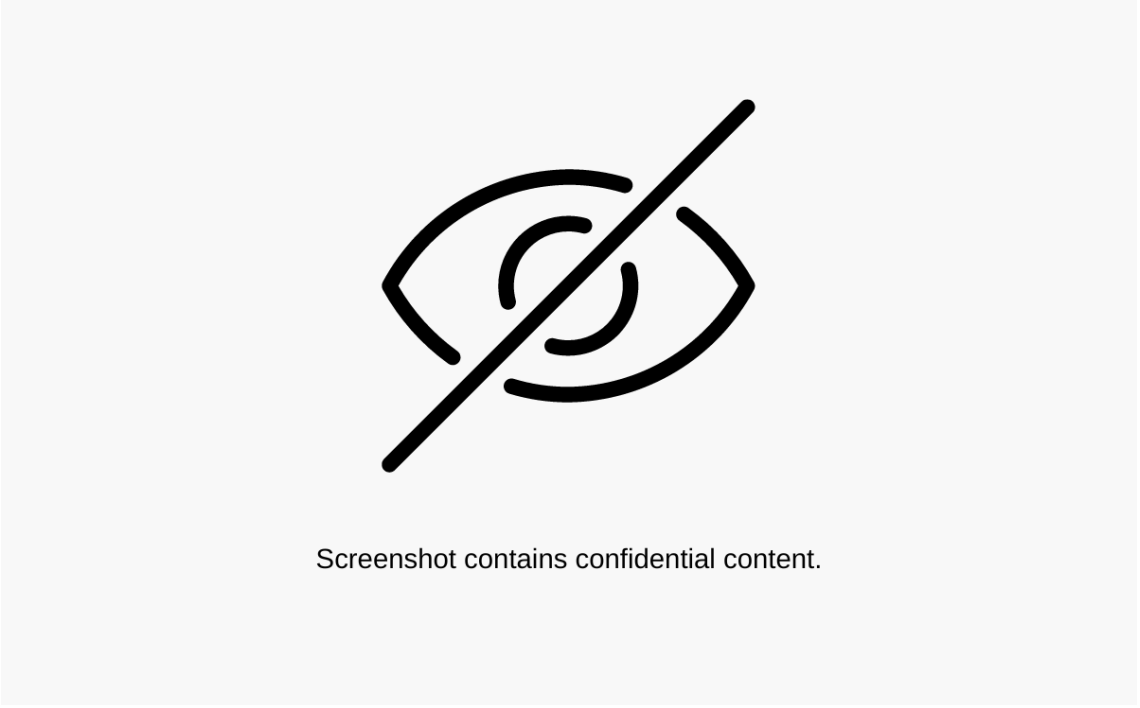


Figure 7. Synonym UI design

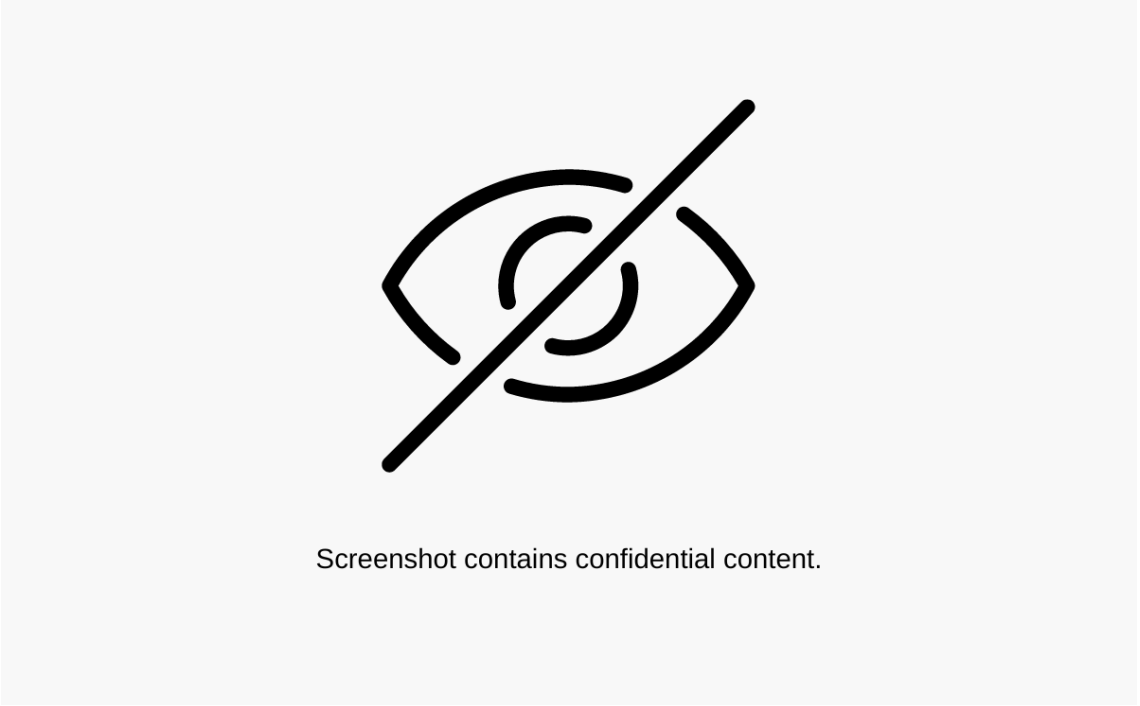


Figure 8. Create synonym UI design

- Promote items views: there are two main views about the promoting rules that the company wants to offer its customers. These two views are about attribute level boosting rules and product level one (figure 9 and figure 10).

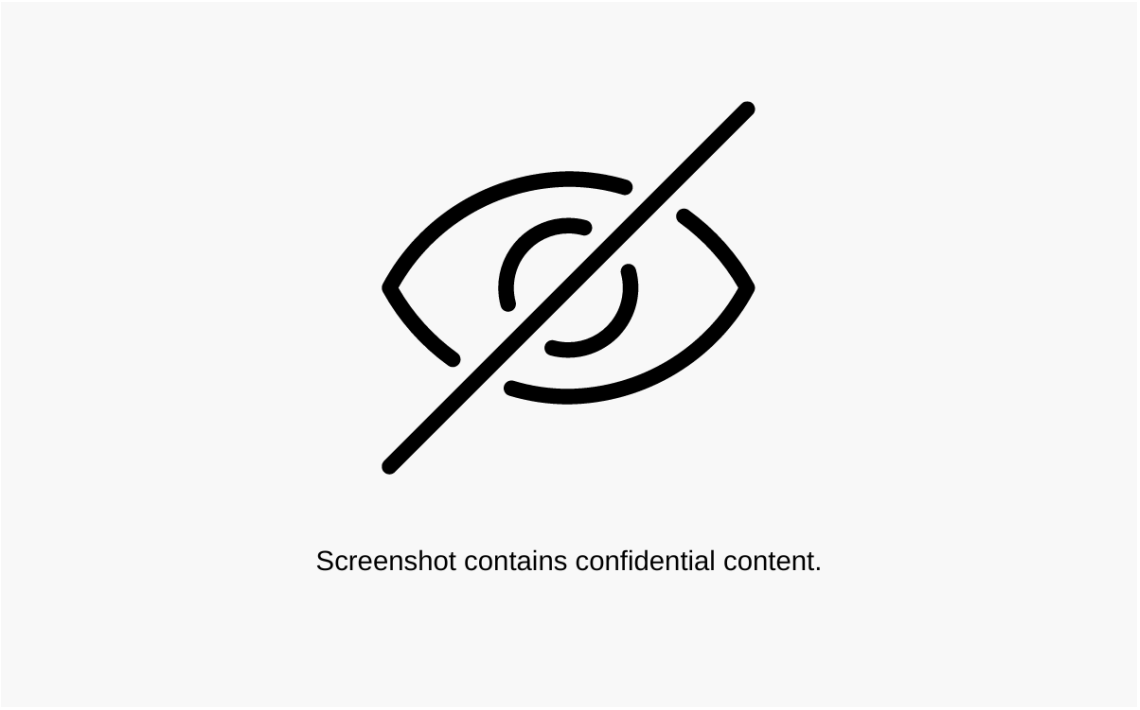


Figure 9. Attribute level boosting view UI design

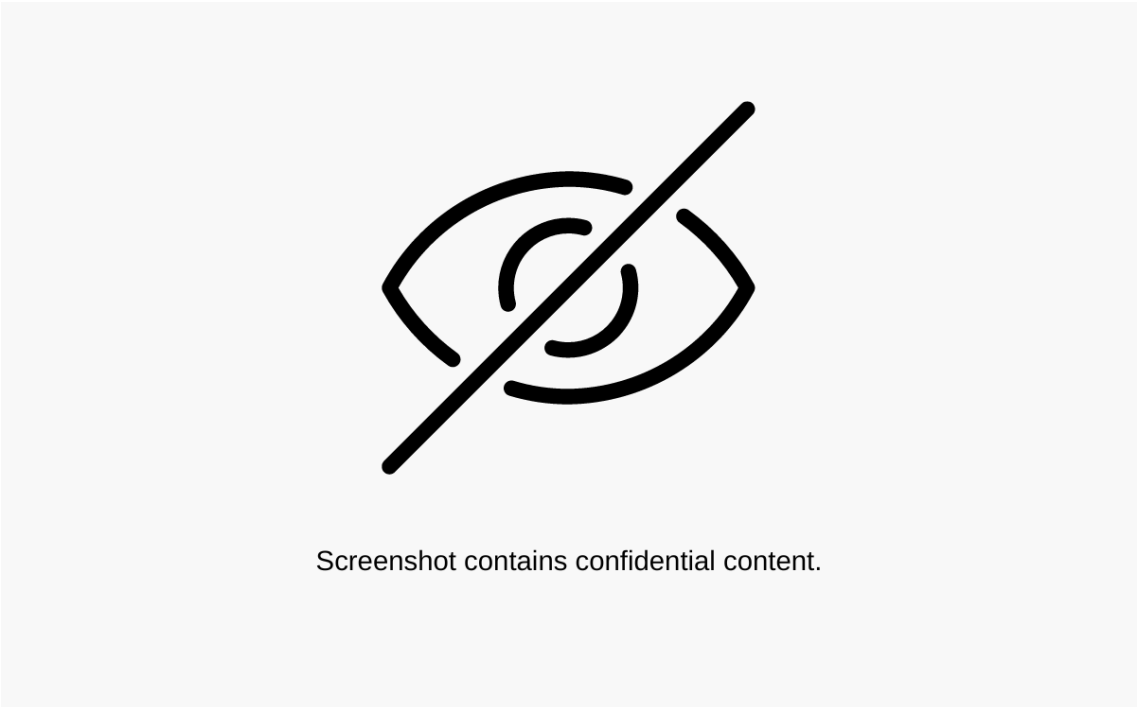


Figure 10. Product level boosting view UI design

4.4 User Experience

4.4.1 The importance of user experience

Because the user's experience is subjective, the best way to directly obtain information is by studying and interacting with users (Stevens, E., 2019). An

element on the page that might seem completely invisible to the user, so a firsthand view of the way they interact with the website can provide valuable insights.

Analyze the people in the target audience when conducting these surveys, as the peer group may interact with the website differently than the target group (Scott, E., 2022). Questions that are raised during the test are: How does the website make you feel? Where did you become confused? How would you go about a purchase? Does the language speak to you? You might be surprised with the amount of constructive feedback you receive (Attributes boost, 2021).

4.4.2 User research method

It has become increasingly common, or perhaps even required for companies to include user research in their design and development process (Portigal, S., 2013).

There are numerous ways to gather data about users such as usability testing, A/B testing, quantitative surveys, web analytics, interviewing, focus groups and so on. Among many different approaches to user research, interviewing is a deep dive into the lives of users for some reasons:

- Interviewing can be used in combination with other techniques, such as identifying key themes through interviews and then validating them quantitatively in a subsequent study.
- At a distance, interviewing looks just like the everyday act of talking to people, and if implemented well, making both parties comfortable enough to share the needed information.
- It can be used to help identify what could be designed to help refine hypotheses about a possible solution that is being considered, which perfectly describe the case of Frosmo Search.

4.4.3 Interview process

As the UI design was divided into several timeframes, the phases for the user test were then followed along. Three internal Frosmo users were invited to see the wireframes for each view and asked to share their opinions on whether or

not the views are up to their expectations and if they will ensure the user experience.

The video interview was chosen as the user research method for this phase. There was a total of four participants including the interviewee, an interviewer, a secretary to take meeting notes, and a developer who is there to understand better what the user may expect so he can plan more detail technically.

As a result, three out of three users were happy with the designs and saw no major issues regarding usability and styles. Overall, the feedback was about the views serving their purpose well and some small concerns were more about how to better visualize the boosting rules regarding the two views - Attribute level boosting and Product level boost. There were a few follow-up meetings and discussions regarding this among the team members, yet no decisions have been made yet until the implementation commences. More tests and feedback collection are expected to come shortly so as for the team to have a deeper understanding of the users' needs.

4.5 Technical Planning

The goal of implementing the new Search feature is for Frosmo users to be able to adjust Instant Search settings and see search statistics.

4.5.1 Feature requirements

- Statistics for
    - most searched terms
    - terms with no results
- Synonyms
- Redirects
    - NOTE: currently implemented in modification template
- Boosting
    - Product-level
    - Attribute-level boosting/weighting

4.5.2 API requirements

- Search Box/Instant Search dialog (uses Search API) currently implements following features:
    - Returns suggested categories
    - Returns items
- Search page (Search API) only supports querying by search term and returns item IDs

4.5.3 Integrating Search to customers' sites

A step-by-step plan on how Frosmo Search will be integrated into a customer's site (figure 11):

1. Frosmo Search reads the site's product data feed.
2. Frosmo Search processes the product data into a searchable format:
    a. The search engine creates and stores a record, known as a document, for each item in the product data. If a document already exists for an item, the search engine updates the document if the item has changed; otherwise, the search engine skips the document. For each item, the search engine only stores attributes defined in the site's attribute schema.
    b. The search engine indexes the documents.
3. On the site, a visitor starts a search:
    a. The visitor types a search term in the search box.
    b. The search box sends a request to the Search API with the search term wrapped inside a search query.
4. Frosmo Search processes the Search API request:
    a. The search engine runs the search query contained in the request against the indexed documents.
    b. The search engine sends a response containing the search results back through the Search API.
5. The site processes the Search API response and renders the search results for the visitor to view and interact with.

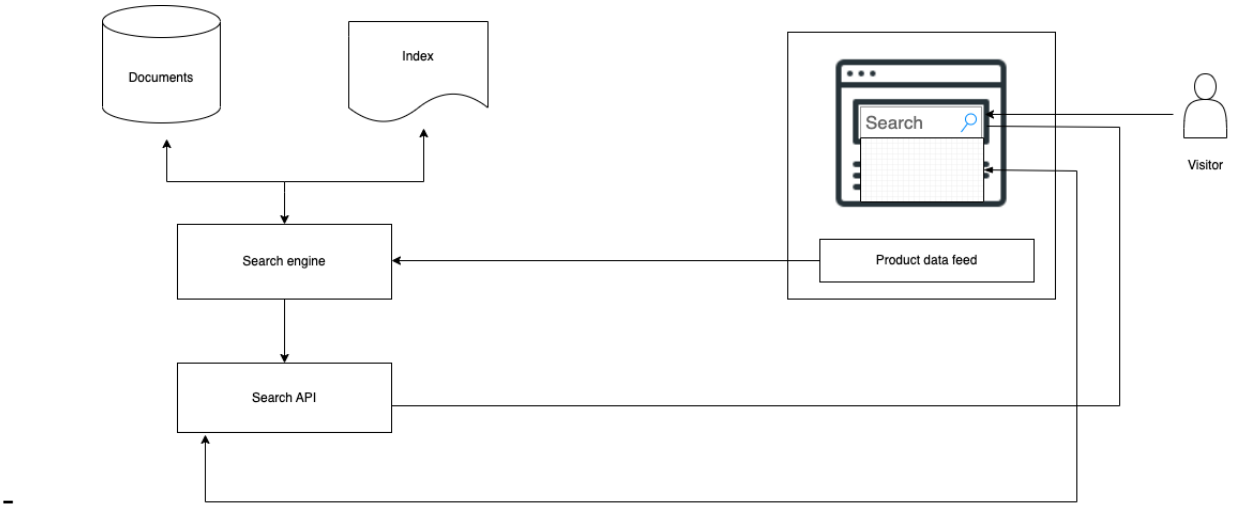


Figure 11. Search user flow diagram

5 Development phase

5.1 Search Parameters and response

The search API returns the IDs of the products that match the search query (TypeSense, 2022). This API is used on a search results page to return the IDs of matching products. The IDs can then be used to fetch the relevant product data with which to build the search results for display (Harrison, P., 2019).

- 5.1.1 Search Parameters

Parameter	Description	Type	Role
`origin`	Client's site origin	String	Required
`perPage`	Number of product returns.	Number	Optional
`filter`	Filtering search results based on product attributes.	String	Optional
`q`	Search query string. Checking condition in the query and returns products corresponding to the condition set.	String	Optional

Table 1: Query parameters for search API requests

- 5.1.2 Search Response (figure 12)

The API returns an object with the following properties:

- `found`: Total number of matching products. This can be greater than perPage.
- `pages`: Page reference used internally at Frosmo.
- `ids`: List of product IDs. These are the IDs of the products that match the search term. The number of IDs is limited by perPage.

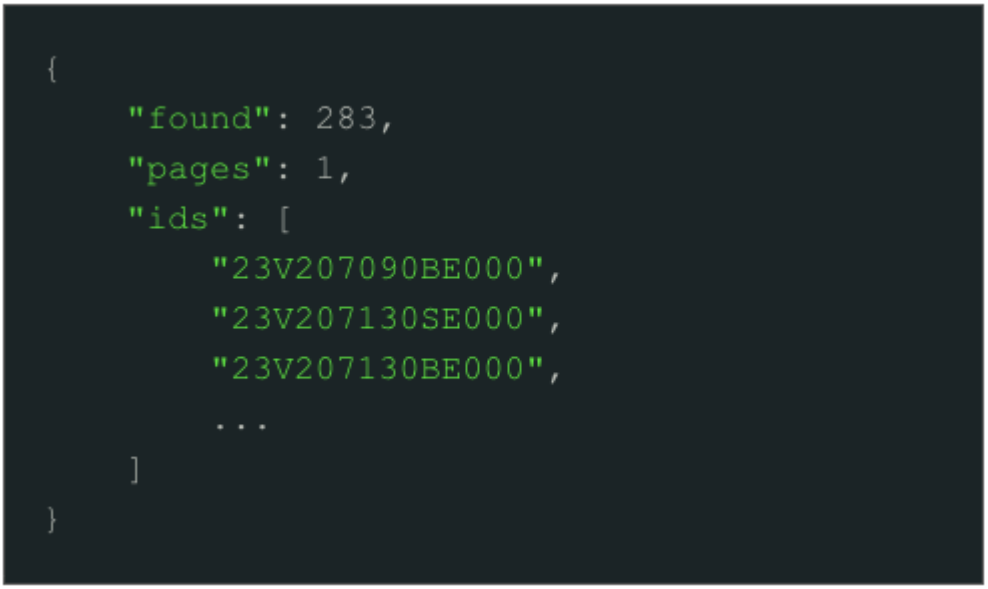


Figure 12. Search Response

5.2 Search Statistics

5.2.1 Search statistics view

Search provides a dashboard that lets customers view insights data and analytics about their end users' shopping behaviors. The analytics shows which products are trendy and which filter option values they have clicked on the most. A list of keywords most entered by end-users and which searches are returning no results will also be available in this view. By getting analytics on

consumer behavior, Frosmo's clients can offer what their customers need and plan one step ahead of their competitors. From here, they can see statistics shown with no extra effort and no coding involved to make data-driven decisions when assessing their site search solutions.

5.2.2 Statistics metrics explanation

The Search statistics view contains metrics that help customers learn more about their customers in greater detail:

- Top search terms which are the most typed in search keywords on the site. By default, the search terms are organized in descending order by total count, with the most popular term at the top (Oro, 2021).
- Top search terms with no results means the most entered search keywords that return no results. By default, the search terms are organized in descending order by total count, with the most popular term at the top.
- Time range: allow selection days for which to display the statistics. The time range is counted from the previous day backwards. The default is 30 days.

Having an insight about these statistics will bring Frosmo customers great benefits (Rule based boosts, search, 2010). From a technical perspective, Search statistics can help them think more objectively about how to configure their product ranking and relevance (Cohen, R., 2022).

Another advantage is that they can use more advanced search API settings to improve their users' search experience. From a business perspective, these metrics will allow the customers to detect the gaps between how items are named or described on the site and how visitors expect them to be (How optimizing Shopify product search and filter can boost your sales?, 2022). As a result, the customers have the option to define synonyms for the most commonly searched terms so as to boost business performance according to their defined business objectives. The same action can be done for the

no-result search terms to return the actual results the end users are expecting (figure 13).

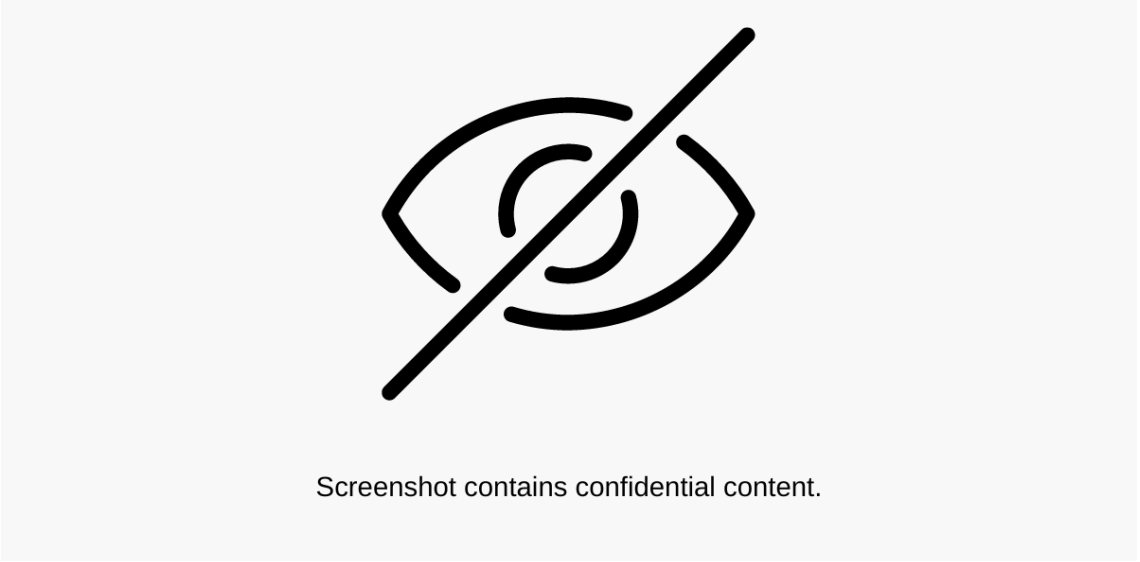


Figure 13. Search statistics view

Analyzing the metrics in figure:

- Search term: Single word or phrase used by visitors to search for items. The search term is always the full search term used in a search.
- Total count: Total number of times visitors have used the search term to search for items.
- Percentage of all searches: Ratio of all searches on the site that the search term accounts for. This is counted follow the formula:

$$Total\ search\ keyword\ count\ /\ total\ all\ searches\ x\ 100$$

5.3 Synonym searching

- 5.3.1 What does synonyms searching mean?

Some customers might only know the synonym for a product name and end up seeing a “No Results” pop-up, and that does not end up as a good user experience (Synonyms, 2019). Frosmo provides a synonym list to help customers define themselves a list of synonyms so that their end users will be more likely to find what they are truly looking for.

In order to help the end users find the product they are looking for, even when the search term they use is not exactly what is stored in data, Frosmo Search

Synonyms allow its customers to define keywords that Frosmo search treats as equivalent, meaning that searching for one term also returns matches for the others (figure 14).

5.3.2 Frosmo supported synonyms types

Frosmo Search supports the following types of synonyms (figure 15):

- One-way synonyms define a unidirectional relationship between a single root term and one or more terms that are to be treated as synonymous with the root term (Rule based boosts, search, 2010). Searching for the root term also returns matches for the synonymous terms, but not vice versa. For example, if you define "blouse" and "tunic" as one-way synonyms of the root term "shirt", searching for "shirt" also returns matches for "blouse" and "tunic".
- Multi-way synonyms define a bidirectional relationship between each pair of terms in a set of terms (Product filters and Search, 2021). Searching for one of the terms also returns matches for all the other terms. For example, if you define "lens" and "objective" as multi-way synonyms of each other, searching for "lens" also returns matches for "objective", and searching for "objective" also returns matches for "lens".

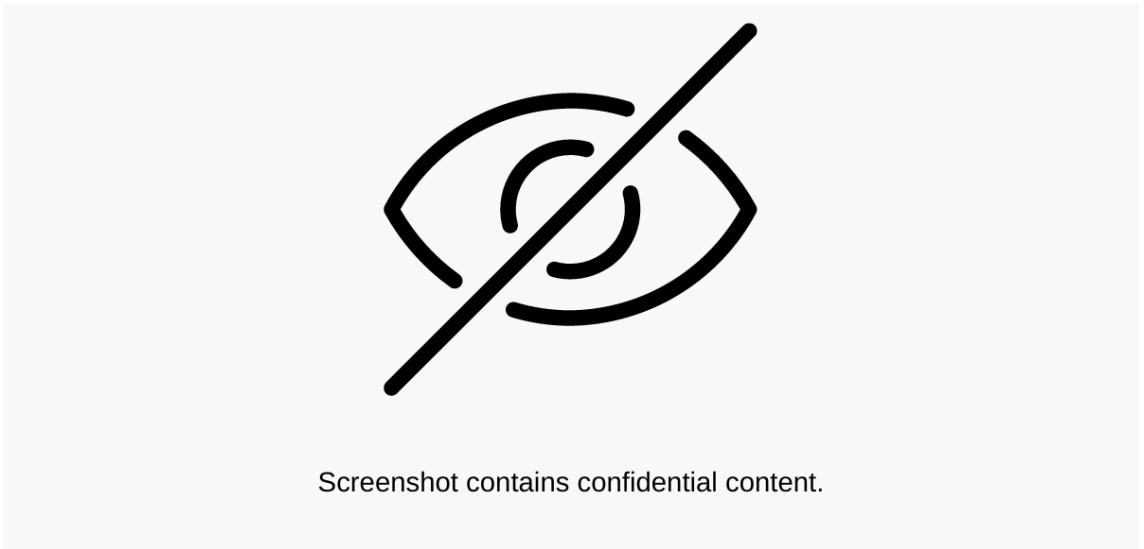
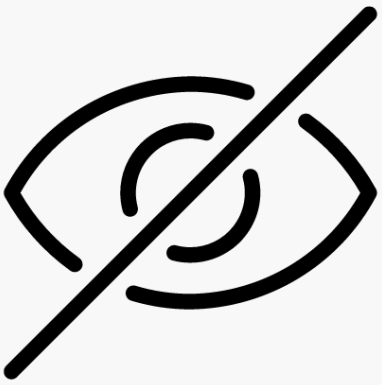
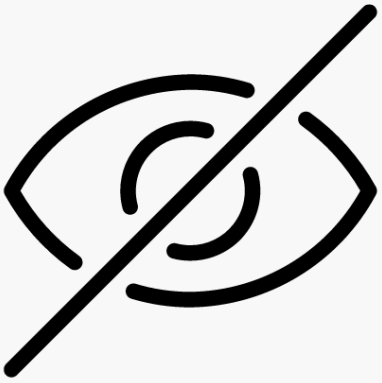


Figure 14. Synonyms view



Screenshot contains confidential content.

Figure 15. Add synonym view



Screenshot contains confidential content.

Figure 16. Edit synonyms view

5.4 Boost and bury rules in search results

Sometimes, businesses would want to rank products in the search results, or manually change their order to personalize and optimize content for their customers (Searchable attributes, 2020). Bearing that in mind, Frosmo Search also introduces two rules for this purpose which are the Attribute level boosting

and Product level boosting so as to help its clients to boost or bury multiple products all at once by ranking specific attributes.

- 5.4.1 Frosmo Search product's boost and weight fields?

Frosmo Search makes it easy to add business logic and apply them to a web app. Without compromising relevancy, products can be either boosted or buried within the search results list (The basis of an instant search widget, no date). Frosmo creates the boosting rules based on the attributes defined and carefully configures the algorithm to include the logic, striking the balance between machine and human intelligence. A customer experience will not be affected by these boosting rules as these are applied on a relevant list of products.

Name	**Type**	**Description**
`frosmo_custom_boost`	int32	Unsigned int value provided by feeds. Read by Instant-Search. Valid values 0-100 (null interpreted as 0).
`frosmo_combined_boost`	int32	Unsigned int value provided by feeds. Read by Instant-Search. Valid values 0-100 (null interpreted as 0).
`frosmo_most_viewed`	int32	Unsigned int value from PlatformApi, used in TypeSense as tertiary tie-breaker for normal searches. Will be used as a filter for sorting by popularity.

`frosmo_most_converted`	int32	Unsigned int value from PlatformApi, used in TypeSense as tertiary a filter for sorting by popularity.

Table 2: Frosmo Search custom rules

5.4.2 The difference between attribute level boosting and product level boosting

Both types of ranking rules will determine whether a certain number of products will be boosted or buried (Hassenzahl M, Tractinsky N., 2006). Attribute level is considered useful and powerful as a set of characteristics can be chosen to apply to a number of products. For example, a boosting rule can be applied for all products with the color attribute “orange”. Meanwhile, product level ranking is more precise as a specific product will be selected to boost (Harrison, P., 2019).

5.4.3 Boosted item settings and user interface

The following table describes the settings you can define for item boosting in the Frosmo Control Panel.

Setting	Description	Role
`Boosting score`	Enter the boosting score for the item. The score must be a whole number between 1 and 100. The higher the score, the greater the boost to the item's ranking in search results.	Required

`Search for items`	When adding boosting for an item, if the item you want is not included in the Items list, search for the item by its ID or name. The list automatically updates with items matching your search.	Optional
`Items`	Select the item that you want to boost.	Required

Table 3: Defining boosting settings for an item

5.5 Target attributes boosting rules

5.1.2 Searchable attributes

When a search query is entered, only product or content attributes that are configured as searchable attributes are searched, and only products or content assets that contain the search term in a searchable attribute are returned in search results. If the searched term is contained in an attribute that is not a searchable attribute and the product is not returned in the search results.

As a best practice, searchable attributes should be confined to the minimum number necessary for customer searches. Searchable attributes contribute greatly to the size of indexes, which affect the speed of returning results.

Searchable attributes being selected have no effect on the attributes chosen for search refinement or sorting rules. However, the boost factor that is selected for a searchable attribute affects the sort order if a sorting rule created uses text relevance as a sorting criterion.

5.5.2 Configure attributes rules

In Frosmo Search, every search operation targets the same set of item attributes. In other words, when visitors execute searches on a site, or when applications call the Search API, the search engine automatically runs queries

against the same set of attributes found in the items indexed for the site (The basis of an instant search widget, no date).

The basic search setup defines the set of searchable attributes available for a site. This setup will help the users to:

- Define the target attributes. Select which of the available attributes that the search actually checks for matches. The site must have at least one target attribute (Fürnkranz, 2013).
- Define relative ranking weights for the target attributes. Customize how the selected attributes get weighed relative to one another when ranking search results (LangShop, 2021). An item that has a match in a high-weight attribute is considered more relevant than an item that has a match in a low-weight attribute. The item with the high-weight attribute is therefore more likely to get a higher ranking than the item with the low-weight attribute (Cohen, R., 2022) .
  For example, if both the name and brand selected as the target attributes, and if you set their weights to 10 and 1, respectively, the search engine gives matches in the name attribute ten times the weight than matches in the brand attribute, significantly increasing the relevance of the former compared to the latter.

5.6 Results

As the setup of Frosmo Search can be technical and sophisticated, the company also provides its users to test the search setup with the feature called **Testing** (figure 17)**.** This means that users are able to test around, seeing how their configuration for the site search will look like in the Frosmo Control Panel before going to production and provide it to the end users. The search works as it would on a site, incorporating the configurations and customizations defined in the Control Panel, and using the Search API for fetching results.

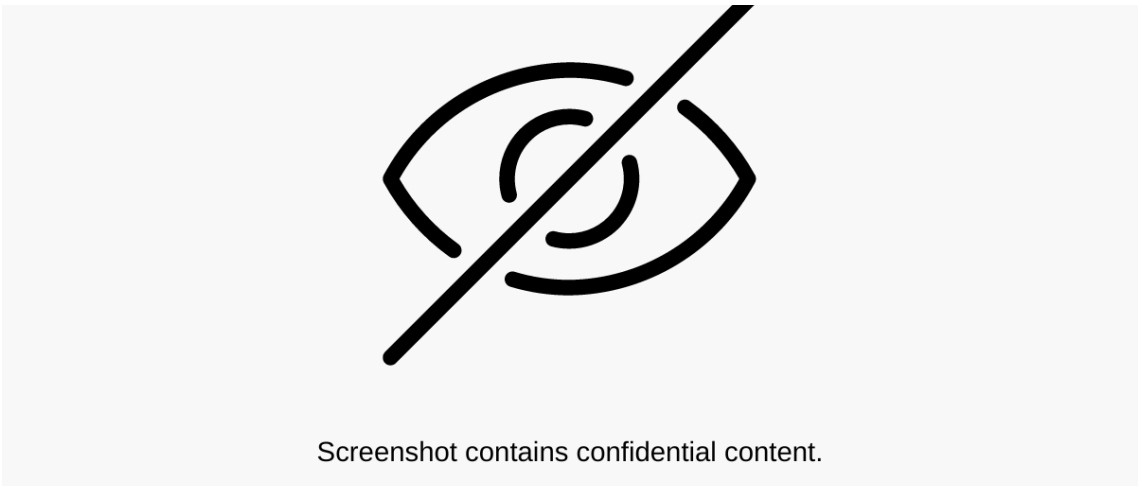


Figure 17. Testing the Search

6 Conclusion

Designing and implementing a new feature always requires a lot of work and effort of not just one individual but the whole team and sometimes, other departments of the organization are involved as well. Frosmo Search is an example of an innovation of a complete, new feature that the company adds to its existing offering. The project started from scratch, and it took more than four months for the add-on feature to be completed and introduced to customers.

As a result, the customers are pleased with what the search can do for their sites and how it helps improve their sales and visitors experience. The first phase feedback round was gathered after a month from the launch, and it indicated that customer's site sales and experience had significantly improved.

This thesis serves as a detailed report of the process, how it was carried out and how much effort was put into bringing it to life. Another purpose of this study was to provide documentation for Frosmo internal users for reference and revision. The documentation can serve as a guide, a reminder, and a walkthrough for them when setting up and enabling the new add-on to customers.

As a result of this thesis, a new, important feature was built for Frosmo. Also, working on this project was a valuable learning experience for the author about

designing a product as well as planning and conducting user interviews. It is important to fully understand user behavior when it comes to interacting with a new interface. Last but not least, it was important to learn how Scrum methodology and code-wise implementation are carried out in an actual organization. This helped to realize how quickly and professionally team members can react to changes and support one another.

- **References**

Kooser, A. (n.d.) *Why Businesses Use Search Engines* [online]. Available at https://smallbusiness.chron.com/businesses-use-search-engines-3277.html (Accessed: 20 December 2022)

Algolia (2020) *Searchable attributes.* [online]. Available at https://www.algolia.com/doc/guides/managing-results/must-do/searchable-attributes/ (Accessed: 01 December 2022).

Harrison, P. (2019) *The complete guide to building Search* [online]. Available at https://dev.to/bnevilleoneill/the-complete-guide-to-building-inline-editable-ui-in-react-1po9 (Accessed: 20 November 2022).

Boost Commerce (n.d.) *The basis of an instant search widget* [online]. Available at https://help.boostcommerce.net/article/800-the-basics-of-an-instant-search-widget. (Accessed: 15 November 2022).

Boost Commerce (n.d.) *Site Search* [online]. Available at https://help.boostcommerce.net/article/811-site-search-faqs. (Accessed: 17 November 2022).

West, D. (n.d.) *Agile scrum roles and responsibilities* [online]. Available at https://www.atlassian.com/agile/scrum/roles#:~:text=What%20are%20the%20three%20scrum,their%20titles%20when%20adopting%20scrum. (Accessed: 12 November 2022).

Scott, E. (2022) *UX Best Practice Design Patterns for Autocomplete Suggestions* [online]. Available at https://baymard.com/blog/autocomplete-design (Accessed: 28 November 2022).

Stevens, E. (2019) *What Is User Experience (UX) Design? Everything You Need To Know To Get Started* [online]. Available at https://careerfoundry.com/en/blog/ux-design/what-is-user-experience-ux-design-everything-you-need-to-know-to-get-started/ (Accessed: 15 January 2023)

Findify (2019) *Synonyms* [online]. Available at https://developers.findify.io/docs/two-way-synonyms (Accessed: 02 December 2022)

Fürnkranz, J. (2013). *Rule-based Methods.* New York: Springer.

Ginee (2021) *The importance of search engine in e-commerce* [online]. Available at

https://ginee.com/ph/insights/importance-of-search-engine-in-e-commerce/ (Accessed: 04 December 2022)

Hassenzahl M, Tractinsky N. (2006) *User experience - a research agenda. Behaviour & Information Technology. E-book* [online]. Available at https://www.tandfonline.com/doi/abs/10.1080/01449290500330331 (Accessed: 20 January 2023)

Iakovliev, I. (2022) *How Ecommerce Search Engine Improves Business and Customer Experience* [online]. Available at https://elogic.co/blog/how-ecommerce-search-engine-improves-business-and-customer-experience/ (Accessed: 10 December 2022)

Schwaber, K. and Beedle, M. (2002) *Agile Software Development with Scrum.* New Jersey: Prentice Hall.

LangShop (2021) *Product filters and Search* [online]. Available at https://langshop.io/blog/boost-product-filter-and-search (Accessed: 15 December 2022)

McGee, M. (2010) *Google Instant Search: The Complete User's Guide* [online]. Available at https://searchengineland.com/google-instant-complete-users-guide-50136 (Accessed: 21 December 2022).

Sunden, J. and Hammarberg, M. (2014) *Kanban in action.* NY: Manning Publications Co.

MIT (2010) *Rule based boosts, search. E-book library [online].* Available at https://ocw.mit.edu/courses/6-034-artificial-intelligence-fall-2010/f0d6c16f941891b8a270b9b6f5358b98_MIT6_034F10_tutor01.pdf (Accessed 16 January 2023)

Oro (2021) *Attributes boost* [online]. Available at https://doc.oroinc.com/bundles/commerce/WebsiteElasticSearchBundle/attributes-boost/ (Accessed: 21 December 2022)

Cohen, R. (2022) *How to identify product attributes* [online]. Available at https://catsy.com/blog/product-attribute-seo/ (Accessed 17 December 2022)

SoBooster (2020) *How optimizing Shopify product search and filter can boost your sales?* [online]. Available at https://sobooster.com/blog/article/optimizing-shopify-product-search-filtering-can-boost-sales- (Accessed 11 November 2022)

Portigal, S. (2013) *Interviewing users.* New York: Rosenfield Media.

TypeSense (2022) *API Reference* [online]. Available at https://typesense.org/docs/0.23.1/api/#what-s-new (Accessed 02 January 2023)

Smith, P. and Reinertsen, D. (2000) *Developing product in half the time.* Canada: Library of Congress Cataloging-in-Publication Data.

Wrike (n.d.) *What is agile methodology in Project Management?* E-book material [online]. Available at https://www.wrike.com/project-management-guide/faq/what-is-agile-methodology-in-project-management/ (Assessed: 12 November 2022).

User Interviews

The user tests were conducted on three internal Frosmo users in form of video feedback session where observations and questions were raised to the interviewees. The target interviewees are those who are working closely with customers and share insights on how they are using the FCP on a daily basis and share their thoughts on what improvements they'd wish to have on the page.

Goal of the meetings:

- To know what they find usable and whatnot as well as what the interviewees consider blockers to their work on the design.
- To know about the users' expectation on how the page can be improved and potential new feature that help increase their work efficiency.
- To let the interviewees freely speak their minds and share thoughts on the page without

Results:

- First interviewee:
    - Thinks that the new Search pages would be working well with all the basic things such as finding modifications, remove/edit/activate/deactivate items are available at hands.
    - For his specific needs and use of this page, it would be useful to have additional sorting and filter logic to find statistics on search terms rather than just "Search with no results" and "Top search terms". That way it would be easier to figure out what the most valuable modifications are.
    - He also wants to find items base on case and did not know that the current filter provides the possibility. Filtering searches by cases can help with spotting the ones that are not in use anymore.
    - Thinks that analyzing data could be improved in terms of time frame as currently there is no graph to spot the start and end time of a group of modifications/recommendations.
- Second interviewee:
    - Finds it hard to find the navigation items he needs with the new navigation design in the beginning.

    - It is hard to find the attributes that is most recently worked on. Suggests to add Sort modifications by most frequently updated.
    - Currently, label is helpful if created in advance to sort items and it is quite intuitive to select a certaion group of attributes and products using label/batch. Customers are suggested to label modifications so that we can help them more easily.
- Third interviewee:
    - Thinks it would be nice to choose what kind of data to be shown in the search statistics.
    - Thinks that as a FCP user for a long time, it is hard to spot what is wrong with the current view. However, he has a few suggestions that can help increase his workflow.
    - Wishes to have possibility to create folder/group for search attributes and products e.g. page type. Although this can be achieved also by creating label, it takes a few steps with label and thus it is not as efficient as having group