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University of Toronto Faculty of Applied Science & Engineering APS112: Conceptual Design Specification (CDS)

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Executive Summary

Our design team was requested by Dr. Kassner of Sick Kids Labs to create a system that generates multimodal summaries of scientific articles. After meeting with the client, our team identified a **gap**, and subsequently a **need** for a website that allows users to navigate between searching/uploading articles and viewing summaries, PowerPoints, and figures.

The **service environment** was subsequently analyzed. The environment of living things includes individuals with disabilities and visual learners. The virtual environment includes password-protected wifi and operating systems. The physical environment is described by the hardware the web user interface will interact with, including ranging display sizes, screen resolutions, and input devices such as mice and keyboards

Key stakeholders were identified. The following list describes the stakeholders and their impact:

- *Kassner Lab:* consists of 5 members thus, the UI will need to support at minimum 5 people
- *Academia and Journal Club Participants:* other research teams may use the program, so it should be intuitive and accessible
- Software Maintenance Companies and User Experience Designers: the user interface should be easy to maintain and update for future developers

From the clients' needs, our team found that the design's **primary function** is to help users navigate between back-end processes. Consequently, the **secondary functions** are:

- Direct users to their desired back end process
- Accept user input for navigation
- Present output from back-end process on request

Objectives were developed from service environment and stakeholder concerns. It was found that the design should be usable, responsive, and perceivable. Additionally, the constraints were fixed by the client, project scope, and codes/regulations relating to the stakeholder interests. Along with other key constraints, the solution must be accessible, include summary formats, and accept user input.

The design team met frequently to generate 60 ideas for the web user interface using methods such as structured brainstorming, functional decomposition, and morph charting. Idea selection techniques such as feasibility checking, multi-voting, and graphical decision charting were used to select three alternative designs:

- *Option 1 FASTPapers:* google search engine replica with recognizable website features for simple user navigation. Displays a list view of article titles that are opened into summaries.
- *Option 2 ASAP Research:* website with simple tab and menu navigation between pages. Displays article summaries, figures, and PowerPoints in easy to read tables.
- *Option 3 PSPro:* offers a simple interface for searching and uploading on the same page. Also uses a top navigation bar for navigation. Light and dark mode is available.

Using the Pugh method, the design team selected **Option 2 - ASAP** as the proposed conceptual design. Considering the main objective of usability, the measures of success include and a plan for extensive usability testing. Looking to the project's future, the design team hopes to develop a feasible prototype for the proposed conceptual design and test its effectiveness using the measures of success.

1.0 Introduction

Researchers at Kassner Lab, SickKids, spend many weekly hours reviewing research articles [1], thus Dr. Kassner has requested our team to design a website for AI-generated summaries and PowerPoints (Appendices A). The document begins with a problem statement, followed by analysis of the service environment and stakeholder concerns, leading to Functions, Objectives, and Constraints (FOCs). Over 60 solutions were generated, and three were described as alternative designs. Finally, the optimal design was proposed, alongside a plan to measure its success.

2.0 Problem Statement

AI websites can provide automatic summarizations of research articles to enhance the scientific research process [2, 3]. Despite this, many processes remain manual and current AI capabilities are limited [4]. We compared existing AI websites like Elicit and Sci Summary (Appendix C), identifying a **gap** for an easy and quick way to navigate between the backend processes:

- Summarizing PDFs [5]
- Summarizing articles from databases using keywords, authors, URL, or DOI [6]
- Presenting key figures and tables [7]
- Generating PowerPoint presentations [8]
- Displaying user search history (Appendix C)

Our client Dr. Andrea Kassner, a senior scientist for Kassner Labs at SickKids, has recognized this gap and requested a design solution for her team (Appendix A). Subsequently, there is a **need** for a simple-to-use and accessible website that navigates users between the backend processes.

Developing backend processes is out of scope as existing AI programs offer them individually (Appendix C). Furthermore, our team lacks the resources to integrate them into the website [9]. Instead, the **scope's focus** will be on the designed website's usability, navigation, ergonomics, and appearance. Since integrating the backend processes is out of scope, the website will solely provide an outline for presenting the output. Therefore, it will include details on how the summaries, PowerPoints, and search history will be formatted, rather than the actual content. We are limiting the design to a website because it is time and cost-effective [10].

3.0 Service Environment

The service environment describes relevant elements which interact with the website. They have been separated into three main categories: physical environment, living things, and virtual environment.

3.1 Physical Environment

The following list describes hardware the website will interact with:

- Screen resolution of a computer screen determines the visual quality (Figures 1 and 2). Most common desktop screen resolutions are 1920x1080 (Full HD), 1366×768 (HD), and 3840x2160 (4K UHD) [11, 12]
- Screen size of laptops and monitors ranges from 13" to 34" [13, 14]



Figure 1. Website on 2160p 4K [15].



Figure 2. Website on 480p [15].

3.2 Living Things

The following list describes potential users of the design:

- Individuals with vision problems such as color blindness: reduced sensitivity to blue, red and green light [16]
- Individuals with motor problems, such as weakness and limitations of muscular control [17]
- Individuals with cognitive disabilities which affect how they understand information [17]

3.3 Virtual Environment

The following is a list of online elements which the website would interact with:

- Password-protected wifi is available throughout the Client's office (Appendix B)
- Operating System is Windows 11 or Linux and the browser is Chrome (Appendix B)

4.0 Stakeholders

Stakeholders are individuals or groups who have an involvement or interest with the website design and Dr. Kassner's lab (Table 1).

Stakeholder	Project Impact
Kassner Lab	Kassner Lab is composed of 5 members who the website will support [18]. Kassner Lab primarily uses PDFs to store research articles, and uses DOIs and keywords to search for articles.
SickKids Labs and Academia	Surrounding SickKids labs may utilize this website in their work. Thus the website should be accessible and intuitive for a broad range of individuals [1].
Scientific Journal Club Participants	PowerPoint presentations will convey information in Journal Clubs, thus the format should be professional and easy to understand for participants [1] (Appendix A).
Adaptive Software Maintenance Companies	Adaptive software maintenance companies ensure websites function after service environment changes, such as browser

Table 1. Stakeholders.

	updates [19]. Thus the design should be accessible for these companies.
User Experience (UX) Designers	UX designers set standards for website appearance and functionality [20]. Thus the design should follow UX designer recommendations to ensure usability.

5.0 Detailed Requirements

Creativity methods such as Functional Basis were used to generate ideas and provide credibility for the following FOCs, all while considering navigation, ergonomics, and appearance.

5.1 Functions

Considering the client needs a website for facilitating navigation among backend processes (Section 2.0), the primary function was determined using functional basis (Appendix D). Secondary functions were generated from functional decompositions of existing websites (Appendix D). See Figure 3 for an outline of functions.



Figure 3. Functions.

Since integrating the backend processes is out of scope (Section 2), the website will solely provide an outline for presenting the output. Therefore, it will include details on how the summaries, PowerPoints, and search history will be formatted, rather than the actual content.

5.2 Objectives

Considering client and stakeholders' needs, three main objective themes were identified:

- Usable and intuitive: users should easily navigate through the website [21]
- Responsive: the website should assist the user and be flexible [22]
- Perceivable: the user should easily perceive website content [23]

Each theme was broken down into measurable objectives and objective goals were determined using the ISO Standard for Ergonomics of Human-System Interactions (ISO 9241-110) and the Web Content Accessibility Guidelines (WCAG) [24, 25]. Objectives in Table 2 were prioritized through pairwise comparison (Appendix F), with key-word definitions in Appendix G.

No	Objective	Metric	Guideline	Objective Goals	Justification
1	Navigable	Y/N	2.4 Navigable of WCAG	 Current page within website is indicated Links include text description of function 	Enhanced UI navigation boosts user control,
2	Predictable	Y/N	3.2 Predictability of WCAG	• Navigational components have a consistent order and style	[26].
3	Flexible	Y/N	5.5.3 Flexibility of ISO 9241-110	 Users can perform tasks in different orders Users can undo their last action Users can customize the output 	Flexibility satisfies a wide breadth of users (Section 4) [27].
4	Assistive	Y/N	3.3 User Assistance of WCAG	 Prompt user input Provide errors for improper input Help links on every page 	Error identification enhances user satisfaction by allowing the user to perceive what they are doing incorrectly [28].
5	Visually Distinguishable	Contrast Ratios	1.4 Distinguishable of WCAG	 Text to background has a contrast ratio of 4.5:1 Color is not the only means of indicating an action 	Design must accommodate all users, including those with color blindness or vision issues (Sections 3, 4) [29].
6	Graphically Consistent	# of styles	5.3.3 Consistency of ISO 9241-110	 <3 font types, colors, and backgrounds are used Similar elements are presented consistently 	Consistent graphical design improves user performance and satisfaction [30, 31].

Table 2. Objectives with associated goals and metrics.

5.3 Constraints

Constraints were formulated considering accessibility guidelines and functionality standards for web design (Table 4).

Constraint	Metric	Limit	Justification
Accessible Design Per Accessibility sections of the WCAG	Font Size And Color Contrast	 Minimum font size 18pt Size of clickable objects are at minimum 24 by 24 CSS pixels Minimum color contrast ratio 3:1 	Adherence to legal policies ensures equal access [32], while guidelines guarantee accessibility for users (Section 3.2).
Receiving input of various file types	Number of compatible input file formats	Compatibility with the following input types: • Keywords • PDF • DOI	The client requested input via PDF, DOI, or keywords (Appendix B). They are also standard input methods (Appendix D).
Comprehensive summary formats	Number of summary sections	Include a format for the sections: Date Publisher/Authors DOI Methodology Background Information Key Findings Figures, Tables, and Visuals	Based on a survey of 5 PhDs (Appendix F), sections are recognized by AI programs [33] and are standard in most research articles [34].
Compatible with display sizes	Image resolution on different displays	Minimum 1024 x 768 resolution, including images and text [35], displayed on all monitor sizes (Section 3).	Ensures optimal visual quality across various screen sizes and resolutions [36].

Table 4. Design Constraints

6.0 Generation, Selection and Description of Alternative Designs

Using the project requirements, the team developed over 50 unique solutions, which were then narrowed down to the top three designs. This section details the methods used to generate and select the solutions and explores the specifics of the top three alternative designs.

6.1 Idea Generation

During idea generation, team members individually developed over 15 unique solution components (Appendix H). A feasibility check eliminated duplicates and unrealistic ideas, resulting in over 60 unique components. These were categorized by website style, navigation methods, and output format (Figure 4). Multi-voting was conducted to eliminate irrelevant ideas and ensure practicality (Appendix H). A morph chart combined the top components to create over 60 final solutions (Appendix H). Refer to Figure 5 for the idea generation timeline.



Figure 4. Sectional representation of partial solutions



Figure 5. A timeline of idea generation. Note there were 60+ finalized ideas using a morph chart.

6.2 Idea Selection

After compiling full solutions the team re-assessed each for feasibility and alignment with the scope, eliminating ~ 10 ideas (Appendix G). Subsequently, the team used multi-voting to select 10 full solutions (Appendix G). These ideas were compared to the key objectives of navigable and predictable using a graphical design chart (Appendix G), narrowing the design space to three alternatives. A stepwise illustration of this process is shown in Figure 6.



Figure 6. Idea selection process

6.3 Alternative Design Descriptions

After confirming that all three alternative designs met project constraints, each design was compared to the objectives. Tables 5-7 depict this comparison, with green, yellow, and red colors indicating satisfactory, somewhat satisfactory, and dissatisfactory results.

6.3.1 Option 1 - FASTPapers

FASTPapers replicates Google's search engine with recognizable features. Users can search, upload PDFs, access recent summaries, and navigate using the menu (Figure 7). Searching yields options to view articles, generate summaries or PowerPoints, open articles, or perform another search (Figure 8).



Figure 7. FASTPapers Home Page [37] [38]

Users begin by either searching for articles in the search bar or uploading a summary via the upload button. Initiating a search will present links to relevant articles along with the option to view a summary or PowerPoint of the selected article. Uploading a file will immediately display a summary.



Figure 8. FASTPapers Navigation Process

Objective	Corresponding Design Element
Navigable	 Home, menu, or exit button is available on every page (Figure 8) Use of universal icons
Predictable	 Interface is familiar with Google's existing interface [37] (Figure 7) Same search input location Same display of articles found Components are consistently styled and ordered (Figure 8)
Flexible	 Follows the order of Search > Select > View (Figure 8) The user can drag/drop PDF uploads or search through their file manager The user can set filters after searches
Assistive	 Does not provide instructions for its use Relies on the user's intuition and familiarity with Google (Figure 7)
Visually Distinguishable	• All main elements maintain a contrast ratio > 4.5:1 (Appendix J)
Graphically Consistent	 3 font styles Elements are shades of black or white Same icons used for corresponding actions (Figure 8)

Table 5. FASTPapers Objective Criteria

6.3.2 Option 2: ASAP Research

ASAP Research begins with a homepage directing users to start a search (Figure 9). Tabs direct and navigate users between searching for articles, uploading PDFs, and accessing past searches. Alternatively, the user can navigate through the drop-menu (Figure 10). The website accepts user button clicks to navigate between processes.



Figure 9. ASAP Homepage.



Figure 10. ASAP drop-down menu.

After searching, users view tabulated results with each row representing a different article. Columns display summary, figures, and PowerPoint overviews that are expandable via buttons. See Figure 11 for summary generation, and Figure 12 for PowerPoint generation.



Figure 11. ASAP summary generation.



Figure 12. ASAP powerpoint generation.

To upload a PDF, users navigate to the 'Upload PDF' tab from the homepage, where they can view previous uploads or upload a new PDF. After uploading, a summary is automatically generated (Figure 13).



Figure 13. Upload Process.

ASAP RESEARCH ✿ Favorites **Q** Search Articles ⊥ Upload PDF View past searches and favorites. 9 J≡î Sort Past search input 1 Paper Title Date Favorited View Summary PowerPoint View Images Paper Title Date Favorited View Summary View Images PowerPoint Past search input 2 Paper Title Date Favorited View Summary View Images PowerPoint

Finally, users also have the ability to favorite articles. These articles, along with search history, are stored under the "Favorites" tab (Figure 14).

Figure 14. ASAP favorites page.

Overall, ASAP Research helps navigate users through back-end processes and aligns with the objectives because it is usable, intuitive, responsive, and perceivable (Table 6).

Table 6. ASAP Satisfies Key Objectives

Objective	
Navigable	 Website location indicated by navigational tabs (Figure 9) Buttons have text and standard icons (Figure 10) Search results organized in an easy to read navigable table (Figure 11)
Predictable	 Navigational elements arranged similar to common websites [39] Navigational elements appear in consistent order/location (Figures 10 - 14) Article overviews enhance predictability (Figure 11)
Flexible	 Users can perform functions in any order (Figure 9) Pages have a back button (Figure 12) Customization options available (Figures 11, 12)
Assistive	 Text instructions for each input (Figs. 11 - 13) Error messages provided, although no help page is available (Appendix K)
Visually Distinguishable	 All main elements have a contrast ratio > 4.5:1 (Appendix K) Functions are independent of color (Figures 11 - 13)
Graphically Consistent	 Four main colors used (Appendix K) Single font style: Lato Four font sizes: 32, 24, 20, 18 Two main button designs: gray and blue

6.3.3 Option 3- PSPro

PSPro's homepage, showcased in both dark and light modes in Figure 15, presents a visually intuitive gallery view for searching and PDF uploading. Users can connect to Google Drive for convenience. The navigation bar includes options for Home, History, Favorites, and Settings.



Figure 15. Homepage of PSPro

When users search by keyword, they are presented with a list of top matches which can be refined with filters. Each paper offers options to copy citation, summarize, create PowerPoint, view abstract, or download PDF. DOI search provides the paper directly with the same options. Before access, users choose from IEEE, APA, or MLA citation formats. See Figure 16 for illustration.



Figure 16. Navigation Input type- Keyword and DOI



If users upload a PDF, they can drag it into the space or upload from Google Drive/ local computer. They then select their citation format and choose to summarize or create a PowerPoint (Figure 17).

Figure 17. Navigation Input type is uploading/dragging PDF.

Users also can mark presentations or summaries as favorites for easy access via the "Favorites" button (Figure 16-17). Customization and help options are shown in Figure 18.



Figure 18. Settings.

Table 7.	PSPro	Objective	e Criteria

Objective	
Navigable	 Navigation bar, FAQs, and Contact buttons consistently placed. (Figures 15 - 18) Buttons have text descriptions (Figures 15 - 18)
Predictable	 Well-labeled, uniformly colored buttons Consistent button design site-wide (Figures 15 - 18) Same button colors in dark/light mode (Figure 15)
Flexible	 Follows fixed search order Offers dark/light mode (Figure 18) Two filters refine search (Figure 16)
Assistive	 Text instructions and FAQs on each page (Figures 15 - 18) (Appendix I) Return buttons on summary pages (Figures 16) "How To Use" tutorial option in settings (Figure 18)
Visually Distinguishable	• Color pairs ensure a contrast ratio \geq 4.5:1 (Appendix I)
Graphically Consistent	 Four major colors used (Appendix I) Uniform font: Times New Roman Same button colors for dark and light mode (Figure 15)

7.0 Proposed Conceptual Design Specifications

Using Elicit as a benchmark, we applied the Pugh Method to compare alternative designs (Appendix M). ASAP Research emerged as the preferred choice, meeting or exceeding all objectives and fulfilling the client's need for a user-friendly, intuitive, and accessible website for navigating backend processes (Section 2).

ASAP Research's standout feature of presenting articles in tables (Figure 19) enhances usability [40]. Tables allow users to compare article information on a single page, reducing the need for navigating individual summaries [41], while the summary, image, and PowerPoint overviews also boost predictability [42].

ASAP surpasses other designs in flexibility, enabling users to perform tasks in any order with extensive customization (Figures 11-14, 20) [43]. While FastPapers excels in visual distinguishability, ASAP balances aesthetics with contrast standards [44]. Similarly, PSPro boasts superior assistive features, but ASAP's predictability reduces their necessity [45].



Figure19. ASAP tabulated results.



Figure 2.0 ASAP customization.

ASAP Research fulfills the client's needs by offering an intuitive and quick method to navigate between summarizing and generating PowerPoints for research articles. It fulfills functions, exceeds objectives, and satisfies constraints (Section 6.3.2 and Appendix k).

8.0 Measures Of Success

The conceptual design will undergo testing for predictability and navigability. Predictable designs enhance user efficiency [46], while effective website navigation improves content accessibility [47]. These objectives aim to optimize access to summarized articles, a central aspect of the web interface's purpose.

First, a prototype of the website will be created. The <u>prototype</u> will have the same interface as the conceptual design and present all the features required. It will be an interactive design completing all the functions, however, it will generate mock summaries instead.

To adhere to industry standards, the design's compliance with **WCAG guidelines** (from 5.2 Objectives) and **usability testing** [48] will be monitored. Table 8.1 details the testing methods and data collection. The testing will involve:

- **5 Facilitators**: Team members guiding participants through the process [48]
- **15 Participants**: Representative users from target population of students and professors [48, 49, 50]

|--|

Test Method	Data Collection & Significance
User performs tasks Tasks were derived from user goals, transformed into scenarios, and segmented into multiple user interactions (Appendix N) [52].	 Task Success Rate [53] Completed task → successful attempt Calculation: successful attempts/total attempts x100 A success rate above 78% is above average [54]
	 Task Completion Time [53] Measure time from participants' confirmation of task to completion. Calculation: Average the time taken of successful attempts User interactions should be 5-second intervals [55]. Each task should be less than 5 × the number of user interactions (Appendix N)

Usability Testing:

- 1. Gather 15 participants, and separate them into groups of 5. Each group will meet with the team for 1 hour. One facilitator per participant will be allocated.
- 2. Participants will share their screens and complete 5 tasks, with facilitators timing and tracking completion. The tasks are:
 - a. You want to find an article
 - i. You want to generate a summary and export it.
 - ii. You want to generate a powerpoint and export it
 - b. You want to summarise articles you have saved on your laptop
 - i. Generate a summary for your own upload, and export it
 - ii. Generate a PowerPoint for your upload, and export it
 - c. Save a summary you like for later.
 - d. Visit a summary you saved.

Figure 8.1: Timeline including dates, location, and personnel



9.0 Conclusion

In conclusion, we propose ASAP Research to fulfill the client's need for an intuitive and accessible website that summarizes and generates PowerPoints for research articles (Section 7). Our next step involves seeking approval from Dr. Kassner to prototype ASAP Research. Following that, we will develop and test the prototype against usability measures (Section 8). Using the collected data, we'll present ASAP Research as a viable solution for the final presentation.

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Appendix A: Client Statement

Below is a direct copy of the client statement provided to us from Dr. Kassner.

I envision an automated research literature review system using AI, which will provide key points and summaries as a Word file for me and also automatically generate a PowerPoint summary. I would also like to collate several summaries and PowerPoint files from different paper reviews together. This would be very useful to speed up the preparation for talks at Journal Clubs, potentially Teaching and aiding with the write-up of introductions and discussions for manuscripts and perhaps grant applications. Ideally, articles can be imported from Pubmed or Google Scholar and my personal library/reference manager. It would also be useful to export/connect each new reference to my reference manager.

Appendix B: Client Meeting 1 Notes

Below is a summary of the key information obtained within the client meeting with Dr. Kassner on Feb 2 from 3-4pm.

Possible Inputs

- User inputs keywords search for articles through pubmed database isolate relevant articles
- User Inputs PDF of paper
- User Inputs DOI

Output:

- Automatically provides extensive summaries in a word file
- Also provides brief summary (paper abstract) and key graphics directly in system
- Downloadable output
- User has the option to output powerpoints with graphics

Objectives:

- Create bibliography in IEEE, APA, or MLA (can select which format)
- Scientific language along with simplification option
- Usernames + Passwords

Scope:

- Windows and linux compatible
- Chrome compatible
- Must be a software program
- Usable for entire team
- Utilizing cloud based or local applications

Note: Dr. Kassner mentioned a systematic literature review system. However, she said this feature would be optional, and maybe too advanced for us. Therefore, we have decided against including it within our scope.

Other Notes:

- Wifi is available
- Uses Chrome

Appendix C: Client Meeting 2 Notes

Below is a summary of the key information obtained within the client meeting with Dr. Kassner on March 8th from 3-4pm.

Comments about the PR

- Dr. Kassner understood the focus on integrating existing programs into one program through an intuitive user interface
 - Therefore problem statement was to her liking
 - Limited comments about the service environment and stakeholders
 - Mentioned interest in detail required
- Functions were approved
- Objectives were approved
- Constraints were approved
 - The flashing lights did not seem to apply, suggested removing it

General Comments

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- Approved the general direction we were taking
- Mentioned it is very common in the industry to use existing research and data instead of starting from scratch

Appendix D: Problem Statement

Appendix D outlines supplementary information regarding the problem statement. Figure C1 outlines the current process of utilizing AI systems for research. And table C1 describes the current capabilities of AI websites used for scientific research.



Figure 1. Academic research process [59].

Table C1. Capabilities Of Current AI Programs

AI Program	<u>Sci Sum</u> [60]	Humata [61] ChatPDF [62] Reader.AI [63]	Elicit [33]	Sci Space [64]	Canva GPT [65] Beautiful AI [66]	<u>Copilot</u> [67] <u>ChatGPT</u> [68] <u>G cloud AI</u> [69]	<u>Pop ai</u> [70]
Academic Research Specific							
PDF Upload			\checkmark				\checkmark
DOI/URL Upload							
Built-in Searching Of Research Articles							
Text Summary							\checkmark
Customizable Summaries							
Multimodal Summary							
Chat Bot				\checkmark			\checkmark
PowerPoint Creation							

The following list provides general notes on each program:

- <u>Sci Summary</u>
 - Offers summarization from url, pdf, and text.
 - Includes figures in summaries (multimodal).
 - Does not offer powerpoint presentations or synchronization to research databases.
 - Pretty intuitive and clean user interface.
 - Can also collate multiple summaries.
 - Provides a chat option where you can ask specific questions about the paper and it will respond.
- <u>Humata.ai</u>
 - Offers upload of pdf, Doc, Powerpoint.
 - Summarizes text of article, but does not provide multimodal summary.
 - Provides a chat option
 - Other similar applications include: <u>ChatPDF</u>, <u>Reader.AI</u>
- <u>Elicit</u>
 - Offers a search function of a database of public papers.
 - Can also summarize PDFs.
 - Can customize the information that is summarized (ie, choose abstract, methodology, etc)
 - Intuitive and easy to use.
 - <u>Sci Space</u> is very similar to elicit, but offers a chat bot.
- <u>Scite.ai</u> [71]
 - Given a prompt, will generate a response that cites existing papers.
 - You can access the cited papers and read brief excerpts that include the relevant information.
- <u>Scholarcy</u> [72]

- will summarize pdf powerpoint, etc.
- Similar to elicit, it categorizes the summaries into sections.
- It can also provide flashcards
- <u>Copilot</u>
 - Not explicitly for summarizing scientific articles, but you can upload the pdf and it will summarize it.
 - Will not provide a multimodal summary.
- <u>Open AI</u>:
 - provides a variety of AI and LLM tools.
 - Notably ChatGPT 4 can summarize pdfs, and there's custom GPTs that can create presentations (such as <u>Canva GPT</u>).
 - However, like co-pilot the interface isn't streamlined for research article summarizations and does not search databases.
 - Moreover, if you wanted to create presentations, the transfer of information would not be seamless. You would have to manually perform the transfer.
- <u>Beautiful AI</u>
 - Automatically generates powerpoint decs from information and images.
 - Does not summarize any information
- Google cloud Ai models
 - Very similar to open AI models.
 - Lacks an ability to search for research articles.
 - Lacks focus for summarizing research articles.
- <u>Pop AI</u>
 - Comprehensive tools for multimodal summarization and presentation creation
 - However, it does not include research databases.
 - Moreover, not research focussed (similar to open Ai and google cloud).

Appendix E: Function Generation

From the problem statement (Section 2.0), the following primary functional basis was generated: Control the transfer of information. The functional basis translates to the primary function: help the user navigate through back-end processes. Subsequently, functional decomposition was performed on relevant AI programs (Appendix C) to develop the following secondary functions:

- Direct users to their destination
- Accept user input to navigate the website
- Present output from the back end processes

Appendix F: Objectives

This appendix outlines information pertaining to the objectives. Figure E1 showcases the responses for the survey question about the comprehensive summaries content which was conducted with 5 PhDs through google forms.



Figure E1: Responses from the survey

The rank of the objectives were generated using pairwise comparison which is shown in Figure E3.

	Navigable	Visually Distinguishable	Predictable	Assistive	Flexible	Graphically Consistent	Total	Rank
Navigable	-	1	1	1	1	1	5	1
Visually Distinguishable	0	-	0	0	0	1	1	5
Predictable	0	1	-	1	1	1	4	2
Assistive	0	1	0	-	0	1	2	4
Flexible	0	1	0	1	-	1	3	3
Graphically Consistent	0	0	0	0	0	-	0	6

Figure E2. A pairwise comparison of objectives. A link to this comparison can be found here.

Appendix G: Keyword Definitions {Objectives}

Table G1 shows the definition of keywords from objectives.

Keyword	Definition		
• Page	A single viewable unit within a website.		
• Links	Hyperlinks connecting different web pages.		
Navigational components	Elements aiding navigation within a website.		
• consistent	Uniform or standardized across instances.		
• tasks	Actions or operations to be performed.		
• action	Specific behavior triggered by user input.		
• Output	Result or response produced by a system.		
• user input	Information or commands provided by users.		
• Error messages	Notifications indicating incorrect input.		
• Help links	Resources offering assistance or guidance.		
• contrast ratio of 4.5:1	Standard for text-to-background contrast.		
• indicating an action	Signifying an operation or process.		
• elements	Components or parts of a system or design.		

Table G1: Keyword definition

Appendix H: Idea Generation

Team members individually developed a minimum of 15 solution components from research where after they were briefly feasibility checked. Table H1 shows these solution components generated per section after the brief feasibility check.

Input Method					
PDF Upload	Article Search				
PC File Manager	Amazon FIlter System				
Drag and Drop	Search Customization				
Voice Input	Suggestive autofill				
RIch Text Editor	"Recently searched" function				
Textbox	"View similar articles" section				
Output	Format				
Summary Format	Powerpoint Format				
User selects output options	Upload own template				
PDF Preview with User Highlighting	Choose between 2 basic templates				
Word Doc Download	Synchronize with template website				
Gallery of Interactive Data Visualizations	Formatted by summary section				
Gallery of Summary Previews	User chooses included summary topics				
Drag and Drop Summary Creator	User chooses/uploads figures to input				
Recursive Chat Process	Figures automatically formatted				
Endless Summary Previews (Refreshes)	-				
Scroll-Through with Popups	-				
Image Popups with Summary	-				
Real-time Output (ChatGPT Output)	-				
Article and Summary Information Formatted in Table	-				
Accessing Past	Outputs Format				
Photo	Gallery				
Google Drive Clone					
Cale	ndar				
Li	st				
Thumbna	il Preview				
Bookmarking feature					
Past Searches File					

Table H1. Total ideas per section after the feasibility check. See the sheets file for more information.

Brief Summaries of Past Uses				
Method of Navigation				
File Explorer Clone	Module focused (quercus)			
TV Menu Format	1 Large Page			
Point/Click Slides (Prezzi)	Tabbed navigation			
Left/Right/Top/Bottom Panels	Conversational AI			
Slideshow Swiping	Floating Navigation			
Sections Centered at top	Dynamic Progress Tracker			
Drop-down menu	Scroll-Through			
Table with headers	Icon focused Navigation			
Menu options opens different UI pages	Step-by-step survey			
Flowchart website				
Past Searches Format	Miscellaneous Ideas			
Linked Folder	Automatic Powerpoint Generation			
Recent Folder	Powerpoint generated by request			
Virtual Doc Library	Adaptable file viewing			
Date Search	Responsive Website Design			
Keyword Search	Customizable website colors			
-	Customizable text			
-	Customizable theme			

Combining one result from each subsection would result in 5 * 5 * 12 * 7 * 8 * 10 * 9 * 5 = 7560000 combinations of full solutions. Instead of matching solutions from each subsection and creating an extraneous amount of sub-par ideas, the team focused on matching the best ideas from each subcategory seen in the morph chart in Table H2. Note that this only includes the first 10 ideas generated from the morph chart. A full morph chart of the 60 complete solutions can be found in this spreadsheet.

Table H2. A morph chart of full solutions generated from <u>this spreadsheet</u>. Note each color corresponds to the same solution (one idea component chosen per section).

Input Method		Presentation Output			Method of Navigation		Past Searches Format
PDF Upload	Article Search	Summary Format	Powerpoint Format	Accessing Past Outputs	List 1	List 2	-
PC File Manager	Amazon FIlter System	User selects output options	Upload own template	Photo Gallery	File Explorer Clone	Module focused (quercus)	Linked Folder
Drag and Drop	Search Customization	PDF Preview with User Highlighting	Choose between 2 basic templates	Google Drive Clone	TV Menu Format	1 Large Page	Recent Folder
Voice	Suggestive	Word Doc Download	Synchronize with	Calendar	Point/Click	Tabbed	Virtual Doc

Table H2. A morph chart of complete solutions. Each color corresponds to a different solution.

Input	autofill		template website		Slides (Prezzi)	navigation	Library
RIch Text Editor	"Recently searched" function	Gallery of Interactive Data Visualizations	Formatted by summary section	List	Left/Right/Top/Bo ttom Panels	Conversational Al	Date Search
Textbox	"View similar articles" section	Gallery of Summary Previews	User chooses included summary topics	Thumbnail Preview	Slideshow Swiping	Floating Navigation	Keyword Search
PC File Manager	Amazon Filter System	Drag and Drop Summary Creator	User chooses/uploads figures to input	Bookmarking feature	Sections Centered at top	Dynamic Progress Tracker	Linked Folder
Drag and Drop	Search Customization	Recursive Chat Process	Figures automatically formatted	Past Searches File	Drop-down menu	Scroll-Through	Recent Folder
Voice Input	Suggestive autofill	Endless Summary Previews (Refreshes)	Upload own template	Brief Summaries of Past Uses	Table with headers	Icon focused Navigation	Virtual Doc Library
RIch Text Editor	"Recently searched" function	Scroll-Through with Popups	Choose between 2 basic templates	Photo Gallery	Menu options opens different UI pages	Step-by-step survey	Date Search
Textbox	"View similar articles" section	Image Popups with Summary	Synchronize with template website	Google Drive Clone	Flowchart website	Module focused (quercus)	Keyword Search
-	-	Real-time Output (ChatGPT Output)	Formatted by summary section	Calendar	File Explorer Clone	1 Large Page	-
-	-	Article and Summary Information Formatted in Table	User chooses included summary topics	List	TV Menu Format	Tabbed navigation	-

As a result of final ideas developed from the morph chart, sample final ideas were sketched and discussed as shown in Figures H1-H3 on an in-person whiteboard.







Figure H1-H3 above shows the final ideas briefly sketched from the morph chart in Table H2.

Appendix I: Idea Selection

The following Appendix details idea selection for this project. The design team started with a feasibility check as shown in Figures I1-I3, then a multi-voting round in Figures I4-I6.

idea	feasible?			
User Inputs Types				
Drop down menu to select input type (DOI, PDF, Search)				
All input types are visible on screen (like a table with headers)		too much on 1 s	creen	
PC File Manager				
Drag and Drop				
RIch Text Editor				
Textbox				
Voice Input				
AI-thought recognition navigational controls		out of scope, ma	agic solution	
One input type is displayed at a time in a box, but you can switch to a different input type by pressing an arrow to the left or right of the box				
telepathic user input		magic solution		
arrows/sections at the top of the box as a header		magic solution		
Search Customization				
Menu system similar to amazon, to the left and below the search bar				
Search customization expands from "settings" icon to the right of the search bar				
Navigational Elements			green=ves ora	nge=grev area
Top centered navigation bar (constant)			red=no	ngo groj aroa,
Left centered navigation bar (disappearing)				
Table with headers				
Drop-down menu				
Slideshow Swiping				
Module focused (quercus)				
Flowchart website				
1 Large Page				
Tabbed navigation				
Conversational AI				
Floating Navigation		not possible		
Dynamic Progress Tracker				
VR Interface		not within scope	•	
File Explorer Clone				

Figure I1. Feasibility Chart (1/3)

TV Menu Format			
Left/Right/Top/Bottom Panels			
Point/Click Slides (Prezzi)			
Icon focused Navigation			
4-dimesnion navigation	magic solution, r	makes UI complic	ated
"tutorial" on how to use site for first time user			
Website has tabs (like Chrome) to keep track of past actions	compatible ?		
Summary Format			
User chooses included summary topics			
PDF Preview with User Highlighting			
Real-time Ouput (ChatGPT Output)			
Gallery of Interactive Data Visualizations			
Drag and Drop Summary Creator			
Recusive Chat Process			
Endless Summary Previews (Refreshes)			
Image Popups with Summary			
Scroll-Through with Popups			
Article and Summary Information Formatted in Table			
Separates different articles by rows and automatically outputs paper title, authors, and doi/access in left column			
Ability to add more columns for different article sections	space?		
Presentation Format			
PowerPoint generation is automatic			
User chooses/uploads figures to input			
PowerPoint generation is only performed upon request			
Figures automatically formatted			
figures allow user to hover over to recieve more context			
Choose between 2 basic templates			
Formatted by summary section			
Synchronize with template website			
3D holographic display	magic solution, o	out of scope	
UI color scheme alternates similar to a mood ring depending on user's emotional state	out of scope, not	t possible, not ne	cessary
user-selected color scheme			
includes last slide of references			

Figure I2. Feasibility Chart (2/3)

templete is standard		
Past Searches Format		
Search a specific date and outputs searches that day		
"View similar articles" section		
Suggestive autofill		
calendar	practicality?	
Thumbnail preview		
Search Customization		
photo gallary		
Amazon Filter System		
Search by keywords to find all past summaries related to them		
Provides a list of all past searches that you can scroll through	memory?	
Past searches just provide brief summaries (no figures or powerpoints), only if expanded is additional information provided		
favorites tab		
miscellanous		
Web page has a banner with header buttons on the top of the screen (similar to footlocker) to navigate to each function of the website, can accept files by opening the computer's file manager, displays summarized articles and ppt as a pdf, displays past summaries in Google Drive's list layout		
Use one long web page where the user scrolls down to each function, drag and drop files to import, displays articles and ppt using a built in file viewer (like quercus), displays past summaries in Google Drive's grid layout		
Have a single menu button to navigate to the website's features, can accept files by opening the computer's file manager, displays summarized articles and ppt as a pdf, view past summaries from a calendar		
Google drive clone: "New Summary" button on top left, most of the page is a list of past summaries, opening a summary will open a new tab/app to view		
Windows file manager clone: a more compact view with a list of website features on the left, small icons, past summaries in a compact list taking up the rest of the screen		

Figure I3. Feasibility Chart (3/3)

idea	# Votes
User Inputs Types	max 2 votes/person
Drop down menu to select input type (DOI, PDF, Search)	0
PC File Manager	5
Drag and Drop	5
RIch Text Editor	1
Textbox	1
One input type is displayed at a time in a box, but you can switch to a different input type by pressing an arrow to the left or right of the box	0
arrows/sections at the top of the box as a header	0
Search Customization	max 2 votes/person
Menu system similar to amazon, to the left and below the search bar	3
Search customization expands from "settings" icon to the right of the search bar	2
Navigational Elements	max 3 votes/person
Top centered navigation bar (constant)	0
Different menu options and opens a different UI web page	2
Table with headers	4
Drop-down menu	0
Slideshow Swiping	1
Module focused (quercus)	0
Flowchart website	3
1 Large Page	0
Tabbed navigation	0
Dynamic Progress Tracker	2
File Explorer Clone	0
TV Menu Format	2
Left/Right/Top/Bottom Panels	0
Point/Click Slides (Prezzi)	0
Icon focused Navigation	1
"tutorial" on how to use site for first time user	2
Summary Format	max 3 votes/person
User chooses included summary topics	3
PDF Preview with User Highlighting	4

Figure I4. Multivoting Round 1 (1/3)

Real-time Ouput (ChatGPT Output)	0
Gallery of Interactive Data Visualizations	1
Drag and Drop Summary Creator	2
Recusive Chat Process	0
Endless Summary Previews (Refreshes)	1
Image Popups with Summary	0
Scroll-Through with Popups	2
Article and Summary Information Formatted in Table	2
Separates different articles by rows and automatically outputs paper title, authors, and doi/access in left column	2
Presentation Format	3 votes
PowerPoint generation is automatic	0
User chooses/uploads figures to input	3
PowerPoint generation is only performed upon request	4
Figures automatically formatted	0
figures allow user to hover over to recieve more context	0
Choose between 2 basic templates	0
Formatted by summary section	4
Synchronize with template website	3
user-selected color scheme	0
templete is standard	0
Past Searches Format	2 votes
Search a specific date and outputs searches that day	1
"View similar articles" section	3
Suggestive autofill	1
Thumbnail preview	0
Search Customization	1
Search by keywords to find all past summaries related to them	2
Past searches just provide brief summaries (no figures or powerpoints), only if expanded is additional information provided	1
favorites tab	6

Figure I5. Multivoting Round 1 (2/3)

miscellanous	1 vote
Web page has a banner with header buttons on the top of the screen (similar to footlocker) to navigate to each function of the website, can accept files by opening the computer's file manager, displays summarized articles and ppt as a pdf, displays past summaries in Google Drive's list layout	1
Use one long web page where the user scrolls down to each function, drag and drop files to import, displays articles and ppt using a built in file viewer (like quercus), displays past summaries in Google Drive's grid layout	1
Have a single menu button to navigate to the website's features, can accept files by opening the computer's file manager, displays summarized articles and ppt as a pdf, view past summaries from a calendar	0
Google drive clone: "New Summary" button on top left, most of the page is a list of past summaries, opening a summary will open a new tab/app to view	2
Windows file manager clone: a more compact view with a list of website features on the left, small icons, past summaries in a compact list taking up the rest of the screen	2

Figure I6. Multivoting Round 1 (3/3)

The multi-voting figures (I.4-I.6) represent that of partial solutions. Each section was allocated a specific number of votes per person. Following this round, multi-voting was performed upon full-solutions where each team member was allowed a maximum of 10 votes for the 62 full-ideas existing. This is shown in figures I7-I12. Solutions with 4 or greater votes were selected for the graphical decision chart and are highlighted.

solution	# votes
PC File Manager, RIch Text Editor, Drag and Drop, Search Customization, Suggestive autofill, Endless Summary Previews (Refreshes), Drag and Drop Summary Creator, Article and Summary Information Formatted in Table, Synchronize with template website, User chooses included summary topics, Figures automatically formatted, User chooses/uploads figures to input, Brief Summaries of Past Uses, Bookmarking feature, Calendar, Brief Summaries of Past Uses, Slideshow Swiping, Menu options opens different UI pages, TV Menu Format, Flowchart website, 1 Large Page, Conversational AI, Step-by-step survey, Keyword Search, Virtual Doc Library	5
Drag and Drop, Textbox, Suggestive autofill, "Recently searched" function, Image Popups with Summary, User selects output options, Formatted by summary section, Figures automatically formatted, Photo Gallery, Thumbnail Preview, Left/Right/Top/Bottom Panels, Menu options opens different UI pages, Tabbed navigation, Conversational AI, Linked Folder, Linked Folder	0
Voice input, Amazon Filter System, Word Doc Download, Calendar, TV Menu Format, Recents Folder	1
Rich Text Editor, "Recently Searched" Function, User selects ouput options, Choose between 2 basic templates, Photo gallery, Point/Click slides (Prezzi), Floating Navigaion, Date Search	2
Drag and Drop, Voice Input, Search Customization, "Recently searched" function, PDF Preview with User Highlighting, Real-time Ouput (ChatGPT Output), Upoad own template, User chooses/uploads figures to input, Google Drive Clone, List, Drop-down menu, File Explorer Clone, Module focused (quercus), Floating Navigation, Linked Folder, Recent Folder	7
Textbox, "View similar articles" section, Drag and Drop Summary Creator, Upoad own template, Bookmarking feature, Flowchart website, Dynamic Progress Tracker, Virtual Doc Library	1
PC FIle Manager, Amazon filter system, recusive chat process, figures automatically formatted, section centered at top, step-by-step survey, linked folder	2
Drag and drop, "Recently searched" function, PDF Preview with User Highlighting, User chooses/uploads figures to input, Google Drive Clone, File Explorer Cline, Module focused (Quercus), Recents folder	3
Voice input, Search customization, gallery of interactive data visualizations, Choose between 2 basic templates, Past searches file, Table with headers, Icon focused navigation, Virtual doc library,	1

Figure I7. Full-solution multi-voting (1/6)

Rich text editor. Suggestive autofill, Gallery of summary previews	
Upload own template, List, Drop down menu, Tabbed navigation, Date search	2
Textbox, PC File Manager, Suggestive autofill, Image Popups with Summary, Scroll-Through with Popups, "View similar articles" section, Upoad own template, Formatted by summary section, Google Drive Clone, Calendar, Menu options opens different UI pages, Menu options opens different UI pages, 1 Large Page, Step-by-step survey, Linked Folder, Keyword Search	3
PC file manager, search customization, Drag and drop summary creator, Upload own tempalte, Bookmarking feature, Point/click slides (Prezzi), Icon focused navigation, Date search	1
Drag and drop, "Recently searched" function, PDf Preview with user highlighting, user chooses included summary topics, Bookmarking feature, Sections centered at top, Floating navigation, Recents folder	1
Voice input, Amazon filter system, real-time output (ChatGPT output), synchronize with template website, Photo gallery, Left/right/top/bottom panels, Module focused (QUercus), Linked folder	2
RIch Text Editor, Drag and Drop, "Recently searched" function, Suggestive autofill, Article and Summary Information Formatted in Table, Word Doc Download, Formatted by summary section, Figures automatically formatted, Calendar, Bookmarking feature, File Explorer Clone, Table with headers, Scroll-Through, 1 Large Page, Keyword Search	6
PC File Manager, RIch Text Editor, Suggestive autofill, "View similar articles" section, Word Doc Download, Word Doc Download, User chooses/uploads figures to input, User chooses/uploads figures to input, Thumbnail Preview, Past Searches File, Thumbnail Preview, Sections Centered at top, Slideshow Swiping, Dynamic Progress Tracker, Module focused (quercus), Keyword Search, Virtual Doc Library	3
PC File Manager, Virtual Doc Library, Keyword Search, Dynamic Progress Tracker, Slideshow Swiping, Sections Centered at top, Thumbnail Preview, Past Searches File, User chooses/uploads figures to input, Word Doc Download, Word Doc Download, Suggestive autofill, RIch Text Editor	1
Drag and Drop, Amazon filter system,Gallery of summary previews, User chooses indluded summary topics, Brief summaries of past uses, TV menu format, module focused (Quercus), Virtual doc library	0
Voice input, "view similar articles" section, Gallery of interactive data visualizations, user chooses/uploads figures to input. Photo gallery, Menu options opens different UI pages, Dynamic progress tracker, Linked folder	1

Figure I8. Full-solution multi-voting (2/6)

Rich text editor, Search customization, Recusive char process, Choose between 2 basic tempaltes, Google Drive clone, Drop-down menu, Ste-by-step survery, Date search	2
Textbox, Suggestive autofill, Word Doc Download, Endless Summary Previews (Refreshes), Synchronize with template website, Calendar, Left/Right/Top/Bottom Panels	0
PC File Manager, "Recently searched" function, Image Popups with Summary, Figures automatically formatted, List, File Explorer Clone, 1 Large Page, Recent Folder	0
Drag and Drop, Amazon Filter System, Real-time Ouput (ChatGPT Output), PDF Preview with User Highlighting, Choose between 2 basic templates, Upoad own template, Photo Gallery, Google Drive Clone, Left/Right/Top/Bottom Panels, Dynamic Progress Tracker, Keyword Search, Point/Click Slides (Prezzi), Conversational AI, Linked Folder,	3
Voice Input, Search Customization, Article and Summary Information Formatted in Table, Formatted by summary section, Past Searches File, Drop-down menu, Scroll-Through, Date Search	1
RIch Text Editor, Suggestive autofill , User selects output options, Choose between 2 basic templates, Thumbnail Preview, Slideshow Swiping, Floating Navigation, Linked Folder	0
Textbox, "Recently searched" function, PDF Preview with User Highlighting, Synchronize with template website, Brief Summaries of Past Uses, TV Menu Format, Icon focused Navigation, Virtual Doc Library	1
PC File Manager, "View similar articles" section, Gallery of Interactive Data Visualizations, User chooses included summary topics, User chooses/uploads figures to input, Thumbnail Preview, Left/Right/Top/Bottom Panels, Date Search, Floating Navigation	0
Drag and Drop, Amazon Filter System, Gallery of Summary Previews, Synchronize with template website, Calendar, Sections Centered at top, Module focused (quercus), Date Search	2
Voice Input, Suggestive autofill, Scroll-Through with Popups, Upoad own template, Google Drive Clone, Flowchart website, 1 Large Page, Recent Folder	1
RIch Text Editor, Search Customization, Drag and Drop Summary Creator, User chooses included summary topics, Bookmarking feature, Menu options opens different UI pages, Scroll-Through, Virtual Doc Library	6
Textbox, Suggestive autofill, Recusive Chat Process, User chooses included summary topics, Google Drive Clone, Table with headers, Conversational AI, Recent Folder	1

Figure I9. Full-solution multi-voting (3/6)

PC File Manager, "View similar articles" section, Endless Summary Previews (Refreshes), Synchronize with template website, Past Searches File, Point/Click Slides (Prezzi), Tabbed navigation, Date Search	3
Drag and Drop, "Recently searched" function, Word Doc Download, Figures automatically formatted, Bookmarking feature, File Explorer Clone, 1 Large Page, Keyword Search	2
Voice Input, Amazon Filter System, Article and Summary Information Formatted in Table, Formatted by summary section, List, TV Menu Format, Step-by-step survey, Linked Folder	1
RIch Text Editor, Search Customization, Real-time Ouput (ChatGPT Output), Upoad own template, List, Point/Click Slides (Prezzi), 1 Large Page, Keyword Search	5
Textbox, "Recently searched" function, User selects output options, Figures automatically formatted, Photo Gallery, File Explorer Clone, Module focused (quercus), Date Search	2
PC File Manager, Suggestive autofill, Image Popups with Summary, Upload own template, Calendar, Menu options opens different UI pages, Step-by-step survey, Linked Folder	0
Drag and Drop, Amazon Filter System, PDF Preview with User Highlighting, Choose between 2 basic templates, Google Drive Clone, Left/Right/Top/Bottom Panels, Dynamic Progress Tracker, Keyword Search	1
Voice Input, "View similar articles" section, Article and Summary Information Formatted in Table, Choose between 2 basic templates, Thumbnail Preview, Slideshow Swiping, Icon focused Navigation, Recent Folder	1
Rich Text Editor, Search Customization, Gallery of Summary Previews, User chooses included summary topics, Photo Gallery, Slideshow Swiping , Dynamic Progress Tracker, Virtual Doc Library	5
Textbox, "Recently searched" function, Gallery of Interactive Data Visualizations, Formatted by summary section, Brief Summaries of Past Uses, Drop-down menu, Floating Navigation, Virtual Doc Library	1
PC File Manager, Amazon Filter System, Recusive Chat Process, User chooses/uploads figures to input, Past Searches File, Flowchart website, Scroll-Through, Recent Folder	4
Drag and Drop, "View similar articles" section, Image Popups with Summary, User chooses/uploads figures to input, Brief Summaries of Past Uses, Table with headers, Tabbed navigation, Keyword Search	0

Figure I10. Full-solution multi-voting (4/6)

Voice Input, Search Customization, Endless Summary Previews	
(Refreshes), Figures automatically formatted, Calendar, TV Menu Format , Conversational AI, Virtual Doc Library	1
RIch Text Editor, Suggestive autofill, Scroll-Through with Popups, Upoad own template, List, Point/Click Slides (Prezzi), 1 Large Page, Keyword Search	0
Textbox, "Recently searched" function, PDF Preview with User Highlighting, Choose between 2 basic templates, Bookmarking feature, Left/Right/Top/Bottom Panels, Step-by-step survey, Recent Folder	4
PC File manager, "View similar articles" section, Article and Summary Information Formatted in Table, Synchronize with template website, Past Searches File, Drop-down menu, Icon focused Navigation, Linked Folder	0
Drag and Drop, Amazon Filter System, Gallery of Interactive Data Visualizations, User chooses included summary topics, Calendar, Table with headers, Dynamic Progress Tracker, Date Search	2
Voice Input, Search Customization, Real-time Ouput (ChatGPT Output), Upload own template, Brief Summaries of Past Uses, Point/Click Slides (Prezzi), Conversational AI, Virtual Doc Library	1
RIch Text Editor, Suggestive autofill, Word Doc Download, User chooses/uploads figures to input, Thumbnail Preview, Sections Centered at top. Module focused (quercus). Keyword Search	1
Textbox, "Recently searched" function, User selects output options, Figures automatically formatted, Photo Gallery, Menu options opens different UI pages, Tabbed navigation, Linked Folder	1
PC File manager, "View similar articles" section, Gallery of Summary Previews, Figures automatically formatted, List, Sections Centered at top, Icon focused Navigation, Keyword Search	3
Drag and Drop, "View similar articles" section, Drag and Drop Summary Creator, Choose between 2 basic templates, Google Drive Clone, TV Menu Format, Module focused (quercus), Date Search	0
Voice Input, "Recently searched" function, Recusive Chat Process, Formatted by summary section, Past Searches File, Left/Right/Top/Bottom Panels , Tabbed navigation, Recent Folder	5
Rich Text Editor, Search Customization, Scroll-Through with Popups, Synchronize with template website, Bookmarking feature, File Explorer Clone , Scroll-Through, Date Search	2
Textbox, Amazon Filter System, Endless Summary Previews (Refreshes), User chooses included summary topics, Thumbnail Preview, Table with headers, 1 Large Page, Recent Folder	1

Figure I11. Full-solution multi-voting (5/6)

PC File Manager, "Recently searched" function, Image Popups with Summary, Synchronize with template website, Photo Gallery, Slideshow Swiping, Scroll-Through, Virtual Doc Library	2
Drag and Drop, Suggestive autofill, Article and Summary Information Formatted in Table, User chooses/uploads figures to input, Brief Summaries of Past Uses, ,Flowchart website, Step-by-step survey, Virtual Doc Library	4
Voice Input, Search Customization, Real-time Ouput (ChatGPT Output), Upload own template, List, Drop-down menu, Floating Navigation, Linked Folder	2
RIch Text Editor, Amazon FIIter System, Word Doc Download, Choose between 2 basic templates, Bookmarking feature, Menu options opens different UI pages, Floating Navigation, Keyword Search	1
Textbox, Suggestive autofill, Recusive Chat Process, Formatted by summary section, Google Drive Clone, Flowchart website, Dynamic Progress Tracker, Linked Folder	1

Figure I12. Full-solution multi-voting (6/6)

The following 10 ideas gathered from multi-voting were utilized in the graphical decision chart below.

- 1. Elicit UI
- 2. Survey Type
- 3. Slideshow type website
- 4. Top Menu Bar, with upload and output on one page
- 5. apple watch UI
- 6. PDF preview where users highlight sections they want
- 7. Drag and Drop summary creator
- 8. Google UI
- 9. Gallery view of summaries and ppt
- 10. Search upload and customization on one page, then move to summary

OBJ



Figure I7. Graphical Decision Chart of top 10 solutions

Appendix J: FastPapers

The figures used to demonstrate this prototype were made by modifying screenshots of Google in Canva [73].

To test the objective of Visually Distinguishable, the colors for each main UI element were compared in the table below.

Table J.1 FASTPapers elements and their corresponding colors

Elements	Color Used
Logo	1B1B1B
"Summarize" and "Powerpoint" text	1A1C20
"Summarize" and "Powerpoint" button	CACACC
Background	FFFFF
Summary/Powerpoint Viewer Taskbar	464F5B
Summary/Powerpoint Viewer Background	F2F2F2

Table J.2 FASTPaper's Color contrast ratio of background and text

Color 1	Color 2	Contrast Ratio
FFFFFF	1B1B1B	17.22:1 [74]
CACACC	1A1C20	10.42:1 [74]
F2F2F2	464F5B	7.41:1 [74]

Appendix K: ASAP Research

The website prototype was developed using figma and can be accessed using the <u>link</u>. Table J1 lists the colors used for each element of the website. The color contrast ratio was calculated and is mentioned in Table K2.

Table K1. ASAP Research's elements and their corresponding colors

Elements	Color Used
Button Outline	8CA0D7
Button Background	E0E1E1
Background	F1F7ED
Text	000000

Color 1	Color 2	Contrast Ratio
000000	F1F7ED	18.94:1 [74]
E0E1E1	000000	16.03:1 [74]

Table K2: ASAP Research's color contrast ratio of background and text

Figure K1 provides an overview of the flexible navigation process of ASAP Research.



Figure K1. ASAP navigational process. Green represents user input and purple represents the website page.

Figure K2 provides a more in depth description of the search page. When a user enters a search, they are navigated to a page with search results organized into a table that provides an overview of each article, summary, figures, and PowerPoint. The user can choose to:

- 1. Open the original article
- 2. Favorite the article
- 3. View full summaries
- 4. View all figures
- 5. Generate a powerpoint.

Clicking each option opens a corresponding page overlay (Figure K3)

Navigates To Ho	me Page Can Enter New S	Search	Can Modify Filters
ASAP RESEA Contractions for This Search Table Of Fav	ARCH New Search Search Favourites SEARCH TIT orited Article Title Of Favorited Article	Current Filters	ŝ≣ Filters B Filter 2 ⊗ Add ⊕
Paper Info	Brief Summary	Figures	PowerPoint
Paper Title Authors Date DOI	Lorem ipsum dolor sit arnet, consectetur adipiscing elit, in facilisis eros ut pellenterapae solicitudin. Cras magna ligula, porta eget elementum sed, cursus id neque. Proin leo diam, efficitur at mauris nec, posurer auctor velit. Favorite Full Summary	Image 1 Title	PowerPoint Title PowerPoint PowerPoint
Paper Title Authors Date DDI	Lorem ipsun dolor sit amet, consectetur adhiscing ellt, in facilisis eros ut petertesque solicitudin. Cara magne liguis, porta reget elementum sed, cursus id neque. Ploin leo diam, efficitur at mauris nec, posuere auctor velit.	e Title	PowerPoint Title
1	2 3	4	Row Repeated For Each Article

Figure K2. ASAP search page.

Paper Title Image: Word File Of Summary Authors Date Published Dot Link Particle Link Citation Abstract Access IEEE, APA, MLA Citations	 Option To Do	wnload Word File Of Summa	Return to Search Page
Abstract Access IEEE, APA, MLA Citations	Paper Title Authors Date Publish	ed Date Published DOI Link	Article Link Citation
Summary Sections Laven issuen door vit aveit, consectoriar adjourge all. Otian interform imported exterior net adhress. In toda, targin, carses of sengers it amet, underinger non rudia. Maria sidamosper para and sidamosper para and and under sent amet, what are it difficies. Yhvense at difficient parts and a benchure. Prosece exterior adjourd against feed allows. Abstract ®	Summary Sections	Abstract Laren ipson delor al anet, consectetar adipiccing ell. Dian tarpis, consos el seruper al anet, suderistipar non radia. Masa varios esci utilities, "Vivana al dien porte nagas bactas bib nunc congor gais. Buquendisse quis guan vitae tarpis adigua	Access IEEE, APA, MLA Citations interfum imperflet even attrices, in tellus is utenesser paras near each convolte, sh awart mean. Praceets in visit.
Background Image: 1 Title Methods Image: 1 Title	Background (8) Methods (8) Key Findings (8) Conclusion (8) Add Section (16)	Background Loren journ duiter th annet, consectetur adipiticing elfs. Etturn interdent impendiet erein mon ubtices. Is tellus tagist, careau et sengre elf annet, scolenbage non nalla. Manh ubticespre grans non ener cenarilla, elf annet varias orci altricies. Wonness et obligate taggen quan, id sodales nauc conge qui. Suquestise quan vitar tagis alquans tingigit a lin elli. Cara consectenter era at manse ventibulare corras. Carabian tricciaet consectente pans, enn sudales uran robus elli annet.	Image 1 Title
Methods Image 2 Title Construction of the state of the	Methods Loren jauan deler dt anet, cansectetar itels tarpis, carsas et oerger it anet, u it anet salva er di dirkiele. Crac ceseel consectetar parus, son soldeke urva reto consecutar parus, son soldeke urva reto Cos consectetar ent et ressa vollbeler retore at anet. Nins planetto ville egr digitalen consecuto. Pelestenger et ago	adipiscing effi. Etian interdum impendiet enim non uttrices. In nimisigue non ruda. Maaris ultancasper pares non canvalis, eta eratu massa vestibukan carsas. Canbihar fiscidant en dramas. Canabihar tincidant consectedar paras, non nodales ura sulla socieringar, one borren massa existend field a odio et ni et listas. Name a faacibas libero. Canabihar vel comendo orci, in	Image 2 Title

Figure K3. ASAP article summary overlay after clicking "Full Summary".

Appendix L: PSPro

The website prototype was developed using figma and can be accessed using the <u>link</u>. Figure L1 shows the FAQs page which helps the user to answer some basic questions.

PSPro	HOME	HISTORY	FAVOURITES	SETTINGS
	 What citation forr IEEE APA MLA Can I access papery Yes, under histo Are there filters that Yes, filters incluited Can I customize presentations comparing Yes, choose from How do I download Presentations compating Yes, it works on Can I save search Yes, also you can also you can also you can be also you	er summaries? er summaries? rry tab. o refine search result de publication date a presentations? m templates or uploa ad presentations? an be downloaded as ole with all browsers? major browsers like history? an bookmark papers support? gh the "Contact Us"	s? nd journal. d custom designs. ; PPT or PDF. Chrome, Firefox, Safari, a in your browser. page on the PSPro websi	nd Edge. te

Figure L1: FAQs webpage

Total 4 colors were used in each dark and light mode. Table I1 shows the list of colors used. According to 1.4, Distinguishable WCAG Text to background should have a contrast ratio of 4.5:1. Table I1 and Figures L2-L4 shows the test for contrast ratio using an online color contrast ratio checker. [75]

Component of the website	Light Mode	Dark Mode
Background	FBF7F4	262223
Foreground Color {Panel color}	F7E5D9	F7E5D9
Navigational elements background/ Buttons	EBCBBF	EBCBBF
Text Colour	683B2B	683B2B

Table I1.	PSPros's	elements	and their	· correspondir	ig colo	ors
-----------	----------	----------	-----------	----------------	---------	-----

Table I2: PSPros' color contrast ratio of background and t
--

Color 1	Color 2	Contrast Ratio
683B2B	EBCBBF	6.14:1 [75]
683B2B	F7E5D9	7.63:1 [75]
F7E5D9	262223	12.85:1 [75]

Appendix M: Proposed Conceptual Design

Using Elicit as the datum, we compared the three alternative designs with a five-point scale Pugh Chart to select our final recommended design (Table M1).

Objectives	Elicit	ASAP	FASTPapers	PSPro
Navigable	0	+2	+1	+2
Predictable	0	+2	+2	+1
Flexible	0	+2	0	-1
Assistive	0	0	-2	+2
Distinguishable	0	+1	+2	+1
Consistent	0	0	+1	0
Totals:	0	7	4	5

Table M1. Pugh Method with five-point scale

Since ASAP Research has the highest score, it was selected as the final design proposal.

Appendix N: Generating Task Scenarios for Usability Testing

User goals for the website:

- Input an article into the website
- Generate a summary or PowerPoint for the article
- Export the summary or PowerPoint
- Like and visit past liked summaries

Table N1: Task Scenarios, each user interaction, and total time allocated:

Task	User Interactions	Total Time (interactions x 5 s)	
	Search Article Route	-	
You want to find an article	 Start: Home Select filters (Optional) Click Search button End: Article list page 	10 s	
You want to generate a summary and export it.	Start: Article list page Click "full summary" Click "word file of" End: New tab opened	10 s	
You want to generate a powerpoint and export it	Start: Article list page Click "powerpoint" Click "download powerpoint" End: New tab opened	10s	
	Upload Article Route		
You want to summarise articles you have saved on your laptop	Start: Homepage Click on upload pdf End: Upload page	5 s	
Generate a summary for your own upload, and export it	 Start: Upload page Click on "view summary" Click download End: New tab opened 	10s	
Generate a powerpoint for your upload, and export it	 Start: Upload page Click on "view powerpoint" Click Download End: New tab opened 	10s	
Favourite			
Save a summary you like for later.	Start: Article list page • Click on heart	5 s	

Visit a summary you saved.	Start: Home page • Click on favourites	5 s
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