LifeLens 2.0: Improving Efficiency and Usability in Lifelog Retrieval Systems through UX/UI Design

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ABSTRACT

In lifelogging, user experience is one of the most important features as it provides accessibility and efficiency. A well-designed and intuitive interface minimizes errors and frustration, which provides the ability to find a specific lifelog image quickly and easily. Although lifelogging is well-established for retrieving information, there's still much to explore in improving user experience. This paper presents the development of LifeLens 2.0, a lifelogging system designed to capture, organize, and retrieve personal life events through advanced wearable technology. LifeLens introduces significant enhancements over LSC24. By adopting a minimalist yet vibrant design philosophy, we have also redefined the user interface to be more appealing and intuitive. These enhancements demonstrate our dedication to merging user-friendly design with efficiency, catering to both novice and expert users in the lifelogging field.

CCS CONCEPTS

• **Information systems** → **Multimedia databases**; **Users and interactive retrieval**; *Search interfaces*; • **Human-centered computing** → **Interactive systems and tools**.

KEYWORDS

lifelog, interactive retrieval, information system, user experience

1 INTRODUCTION

Growing interest in recording ourselves, cheaper computer storage and sensing technology has led to the emergence of lifelogging.

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Lifelogging is the process where people can capture, collect, organize and revisit events of an individual's life using a variety of wearable devices [5]. The purpose of lifelogging can vary as people may seek to record information about their health, personal experience, emotions or other aspects of their lives. However, one of the crucial requirements of the lifelog system is the ability to find any specific event in history. To achieve an efficient search mechanism, we embarked on a project to refine LifeLens [8] at LSC'23 [7], focusing on user-friendliness and competitive performance in the Lifelog Search Challenge 2024 [6].

For UX designers, ensuring the user-friendliness of these systems is essential. This necessitates adopting a user-centered design approach, characterized by extensive user testing, prototyping, and iterative design processes. Our second year of engaging with the Lifelog Search Challenge has equipped us with valuable insights into what has been effective and what requires further refinement. The latest iteration of LifeLens presents a streamlined, minimalist, and elegant design, embracing the principle that simplicity enhances user experience. Key improvements include the integration of an all-in-one search bar that combines search, filtering, and timeframe selection for enhanced user navigation and efficiency. Additionally, we refined the drag-and-drop feature to better cater to novice users and introduced shortcuts for quicker actions, aiming to make the system more accessible and competitively robust. For the purpose of demonstration, LifeSeeker [10] system is used as the backend component of the lifelog system. However, ideally, the LifeLens UI is built to be used with any lifelog system.

2 RELATED RESEARCH

We initiated our exploration by analyzing LifeSeeker [10], an interactive lifelog retrieval engine being developed at Dublin City University. LifeSeeker is an interactive lifelog retrieval engine that is under development at Dublin City University. While the backend of LifeSeeker is advanced, its user interface has room for improvement. The shortcomings of the LifeSeeker are validated using the user interface standard such as Web Content Accessibility Guidelines (WCAG) [3] and design principles within the UI/UX design domain [2, 9]. Some of the usability issues identified are:

(1) The query input box is too small for long queries or queries with multiple keywords or concepts. This limitation could affect usability and user experience by reducing the accuracy and efficiency of the query formulation process. Users may be more prone to errors or typos in their queries and may spend additional time effort correcting them. Consequently,
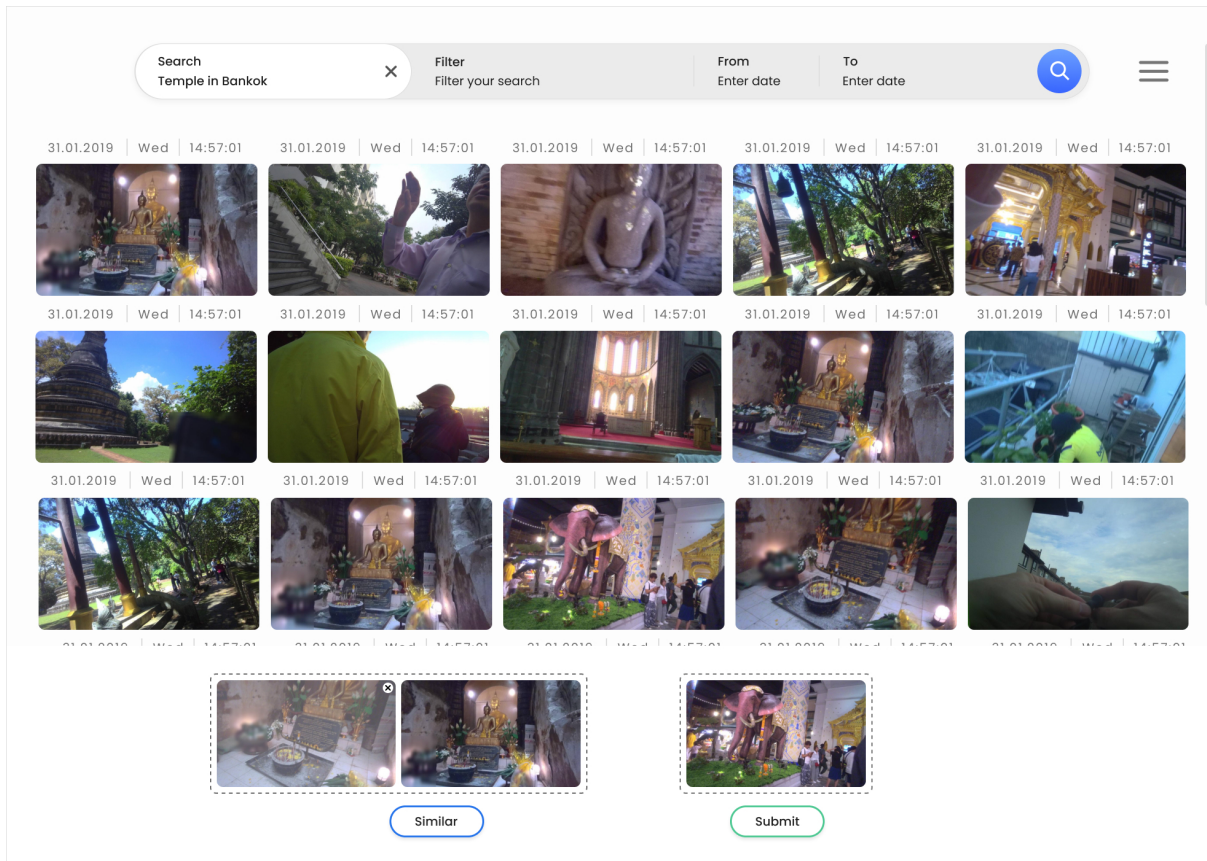
Figure 1: The redesigned LifeLens 2.0 interface offers a minimalistic, consistent, and intuitive design. Key features include a search bar that enables users to find images via text input and a timeline for navigating lifelog data. The interface also incorporates a filter bar for refining search outcomes by time, location, and people. Additionally, it includes a date filter to set specific start and end dates for searches. The search results are displayed in a grid layout on the results page.

users may feel frustrated or dissatisfied with the query input interface.

(2) The timeline slider is too narrow or imprecise for fine-grained navigation through time periods. This limitation could affect the usability and user experience by impairing the flexibility and control of the result-filtering process. Users may not be able to select a desired time range or interval or have to repeat their selection multiple times. Users may also feel annoyed or confused with the timeline slider interface.

(3) The filter and sort panel is too complex and confusing for novice users. This could affect the usability and user experience by hindering the clarity and relevance of the result sorting process. Users may not be able to choose a suitable option for their query or have to try different options until they find one that works. Users may also feel lost or uncertain with the filter and sort panel interface.

In addition to LifeSeeker, we explored several lifelog systems such as Virtual reality lifelog explorer [4], a virtual reality platform to support visual lifelog exploration. Memento [1], a lifelog retrieval system that uses semantic representation of images and

textual queries to facilitate retrieval of lifelog data. Memoria [11] is a computational tool developed to participate in the Lifelog Search Challenge 2022. It is a memory enhancement and moment retrieval application that can retrieve lifelog images based on the search of keywords and time periods. Myscéal [12] is an interactive lifelog retrieval system built with a focus on accuracy and rapid response while supporting natural language queries. The user interface is minimal and interactive that provides users with three boxes at the top named "before", "find" and "after". We have identified several user interface design limitations with these systems and designed the LifeLens system to address these limitations as discussed in [8].

We also analyzed our previous version of LifeLens system [8] from LSC'23. LifeLens was designed and developed by students from University of Bergen and Dublin City University, specifically for novice users. After participating in LSC 2023 workshop, we noticed some design and usability issues associated with LifeLens:

(1) *Inefficient search field:* On the left side of the system, there was a field designed for search, filtering, and timeframe selection. The intention behind this setup was to segregate search and filtering functions, aiding users in distinguishing

between the two distinct actions. However, users found this arrangement confusing, as it cluttered the interface with too many elements, diverting attention from the primary drag-and-drop functionality. Having to navigate multiple fields to input information proved inefficient; it would have been more effective to consolidate these functions into a single, centralized location.

(2) *Difficult to interact with the timeframe:* On the system's left side, a feature enables users to specify both day and date parameters, facilitating the retrieval of images tied to specific dates. However, a notable issue arises between this feature and the surrounding search field. Users encountered difficulty in discerning the relationship among the search field, filters, and date specifications. This lack of coherence within the design can critique us as UX-designers.

(3) *Hierarchy improvement needed:* The page's hierarchy felt cluttered, with an overwhelming amount of information and elements all crowded together on the left side. Space wasn't utilized optimally, prompting us to consider repositioning elements to allow for more breathing room, especially for images. Furthermore, the organization of date, day, and time information lacked clarity, indicating a need for a more efficient and coherent presentation.

(4) *Small images:* While striving to maximize the utilization of available space, we made the strategic decision to employ clustered images, aiming to accommodate as many visuals as possible within the given interface. This approach, however, encountered challenges in terms of user-friendliness. The images were too small, resulting in reduced effectiveness as it was challenging to discern the content of each picture.

From this analysis, we established a clear objective for the new version: to redesign LifeLens, making it both more user-friendly and more efficient.

3 ITERATIVE DESIGNPROCESS

We conducted four iterations of user testing with the new system, LifeLens 2.0. These tests involved both novice users, who have limited technology knowledge and are unfamiliar with lifelogging, and experts in lifelogging and technology, specifically UX design students. Across these four iterations, we implemented improvements and modifications based on the feedback received.

The feedback indicated that the search field was intuitive and effective with everything integrated into a single search bar. Participants found it simple and clear, benefiting from the streamlined functions. The experts conducted searches quickly and appreciated the dual functionality of drag and drop, as well as the option to use shortcuts for faster responses. Novice users, however, found the shortcuts more challenging to understand, preferring to use the drag and drop function, which they were already comfortable with.

Through these iterations, we pinpointed strengths and weaknesses, allowing us to refine the prototype. Each round of user testing, with both novice and expert users, helped us to adjust the system to better meet their needs. This process ensured that our final product was both user-friendly and efficient, for all user groups.

4 OVERVIEW OF LIFELENS 2.0

The default view of the LifeLens 2.0 system is shown in Figure 2. The system features an all-in-one search bar at the top that includes search functions, filters, and a way to choose time periods, making it easy to access at any time. We've kept the drag-and-drop function but moved it to the bottom to make the system more intuitive to use and leave more room for images.

We've updated the system with a new and minimalist approach yet eye-catching design. The refreshed LifeLens logo is lively and incorporates a camera lens in the center, set against a simple color scheme mainly using whites and grays. The new colours, font family, element sizes are all designed and implemented conforming to the WCAG standard [3]. This approach keeps the design clean while highlighting the search bar.
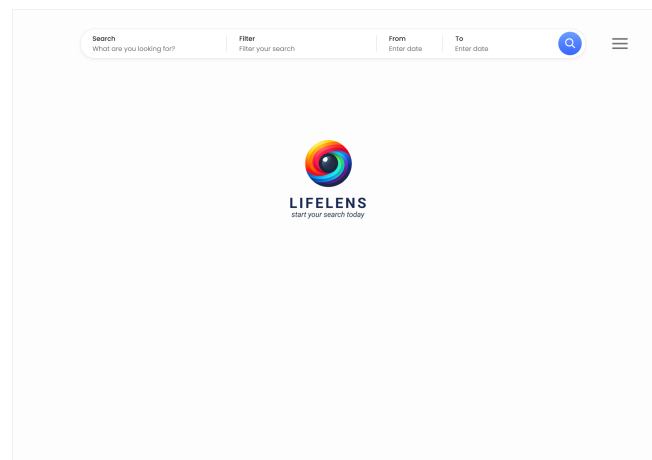

Figure 2: The main (landing) page of LifeLens 2.0

Search Bar: Our integrated search bar combines searching, filtering, and selecting specific timeframes with start and end dates, aiming for maximum efficiency. This design allows users to smoothly navigate and modify their searches directly within the bar, either by building upon their initial search or starting anew. Searches remain saved in the bar for convenience, facilitating easy adjustments or the creation of new queries as shown in Figure 3.
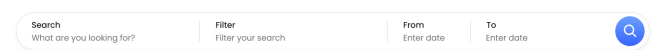

**Figure 3: Integrated Search bar design used in LifeLens 2.0**

Drag-and-Drop: This feature is tailored to ensure users can find the most accurate results for their needs, positioned for easy access at the bottom of the screen as shown in Figure 4. Recognizing that drag-and-drop can be time-intensive, we have introduced shortcuts for adding similar images or submitting entries, enhancing the feature's efficiency. Specifically designed with novice users in mind, this function enhances user-friendliness, making the system more approachable for all users.

Menu: LifeLens 1.0 lacked a Q&A topics function. This function is inspired by Myscéal lifelog system. However, the Q&A function

Figure 4: Drag and drop fields of the LifeLens 2.0 system

in Myscéal is automatically triggered every-time the user performs a new search. During our exploration of the system, we encountered several occasions where the Q&A function was inaccurate, sometimes not needed at all but was still triggered automatically. This not only distracted us but also consumed valuable time, diverting attention from the primary search function. Therefore, we have implemented a solution to switch to this feature by accessing the menu as shown in Figure 5. This allows users to decide if and when they would like to utilize this function.
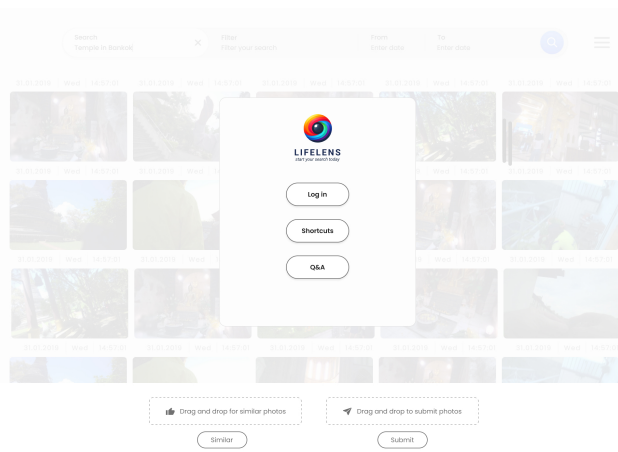
Figure 5: Menu function of LifeLens 2.0 system showing options for accessing Q&A and shortcuts functions

Another salient feature of LifeLens 2.0 system is it now supports keyboard shortcuts to access and interact with different functions discussed above. The users can access the menu and learn the shortcuts supported by our system as shown in Figure-5. The users can also revisit this menu option anytime to remember the shortcuts.

5 IMPROVEMENTS

Throughout the system's redevelopment, we focused on enhancing its user-friendliness while ensuring optimal performance aligned with the standards of LSC 2024. Figure 6 shows the visual differences in the user interfaces of LifeLens [8] and LifeLens 2.0. The upgraded search bar exemplifies this approach. Instead of using different UI elements for search, filter and date selection function, The search bar alone combines search, filter, and date selection into one convenient place, allowing users to easily adjust their searches or start new ones without hassle. This feature significantly speeds up the process, making the system not only more user-friendly but also better suited for the competition where time and accuracy are crucial.

We also enhanced the drag-and-drop feature to make the system more approachable, especially for beginners or novice users, while

also keeping competition needs in mind. By adding shortcuts for quick actions like adding similar images or submitting searches, we've made it faster and more intuitive. This makes the system not only easier for everyone to use but also ensures that it can deliver precise results quickly, which is essential for the competition. These improvements show our commitment to creating a system that's not just simple to use but also highly effective and competitive-ready.

In addition to these functional improvements discussed here and in Section 4, there are several visual user interface changes implemented on LifeLens 2.0 aimed to improve the usability, user engagement and overall user experience of the system. The LifeLens 2.0 system now has a new colour scheme and relative positioning of the UI elements conforming to the widely used and accepted user interface design standard, WCAG [3]. The UI elements are adaptive making only those elements needed by the user at any stage of the user journey through the system are loaded and presented to the user as described in the principles of web content design [2]. This not only enables the users to focus on the most important tasks but also increases the efficiency of system by offloading the resources needed to load the elements later.

The system also provides subtle yet noticeable visual feedback such as the text boxes on the integrated search bar change colours to show the user which boxes are active and used by the user. The drag and drop boxes when selected display an additional border around the box to show the active one and the buttons change colors when a user hovers over them to quickly identify the visual focus of the user.

Another noticeable change in LifeLens 2.0 is the absence of the timeline slider. While testing LifeSeeker, the timeline slider function was mostly ineffective as we could not find many occasions where we could use the slider function. The slider itself was difficult to use as the slider buttons were too small. Also, when working with a large dataset, the slider range should accommodate for a wider physical space to move the slider. Since the physical space on the screen (monitor/laptop) is limited, the slider adjusts the speed of the button movements instead, any small movement of the buttons change the selected value significantly. This makes finding the correct value using the slider buttons extremely difficult. LifeLens 2.0 uses the date selection function in the integrated search bar to implement this function instead of using the slider making it simpler and easier to select the start and end date range.

6 USABILITY AND WCAG

The Web Content Accessibility Guidelines (WCAG) [3] represent a universally recognized set of standards aimed at ensuring digital content accessibility for individuals with disabilities worldwide. These guidelines offer a comprehensive framework for crafting web content that is both understandable and robust. In the development of LifeLens 2.0, we meticulously integrate WCAG principles, particularly focusing on aspects such as color usage, color contrast, and font sizes.

Regarding color, our adherence to WCAG guidelines ensures that sighted users can effectively interpret information conveyed through color and perceive subtle color differences. For instance, the search button within the search field features a significantly
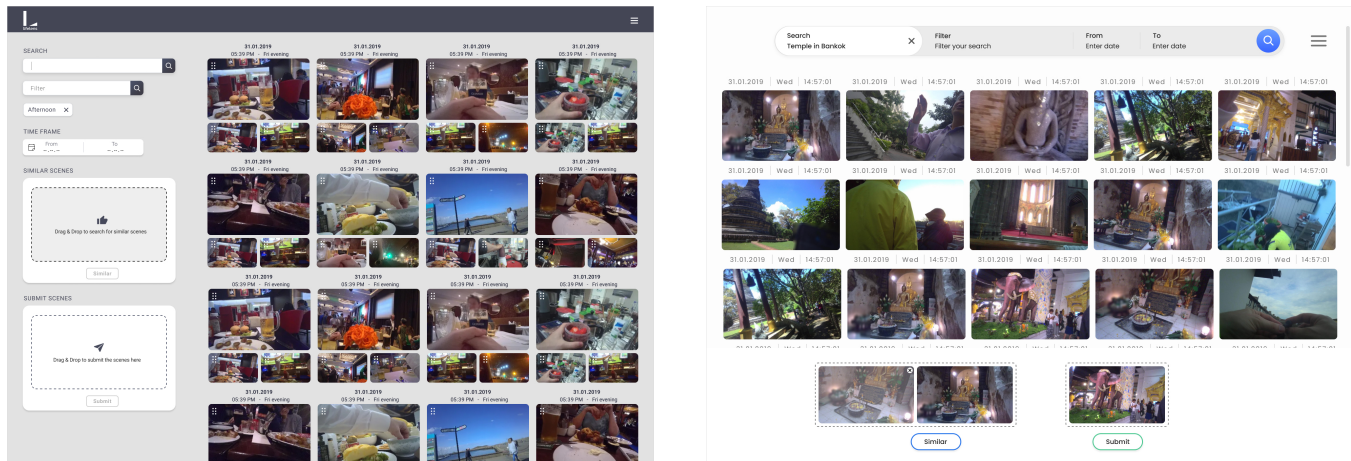
Figure 6: User interface differences between LifeLens (left) (source: [8]) and LifeLens 2.0 (right)

stronger color to emphasize the system's primary function of searching. When a user drags an image into the dropbox field, the button's color transitions from gray to blue and green, signaling a change and providing immediate feedback to the user. The design not only enhances user experience but also ensures seamless interaction by intuitively communicating system responses.

Furthermore, our commitment to color contrast requirements guarantees clear differentiation between text and background elements. This deliberate design choice enhances readability for individuals with moderately impaired vision, eliminating reliance on assistive technology. In our design, we've thus employed a light background color for features, paired with a darker text font. This deliberate contrast enhances readability and ensures a more user-friendly experience.

Additionally, our implementation of a minimum font size of 16 pixels on LifeLens 2.0 webpages further underscores our dedication to accessibility. Using a minimum font size of 16 pixels on web pages enhances readability and accessibility, especially for users with visual impairments or viewing content on smaller screens.

7 CONCLUSION

In conclusion, the evolution of the LifeLens system represents a significant leap forward in the realm of lifelogging technology. By carefully analyzing feedback and results from previous iterations, as well as drawing on our experiences in last year's competition (LSC 2023), we have designed several updates to the LifeLens system that not only meets but exceeds the dual objectives of user-friendliness and efficiency. The introduction of an all-in-one search bar, the refinement of the drag-and-drop feature, conformity to user interface design standards, policies and guidelines exemplify our commitment to creating an intuitive, seamless user experience while catering to the specific demands of competitive settings.

LifeLens 2.0 includes several such functional and visual user interface design improvements. Some of the improvements discussed in this paper are a new integrated search bar, upgraded interactive drag-drop boxes with visual feedback and manual trigger of the updated Q&A function. Additional enhancements include updated

fonts, color schemes, and UI element sizes and positioning that adhere to WCAG standards. These improvements are discussed in Sections 4 and 5.

Our design philosophy, which emphasizes minimalism without sacrificing vibrancy, ensures that users are greeted with an interface that is both pleasing to the eye and functional. With this approach, coupled with the strategic enhancements made to both the search functionality and the drag-and-drop feature, our aim is to establish LifeLens as the choice of user interface for future lifelog systems. As we look forward to the Lifelog Search Challenge, we are confident that these improvements will not only enhance the user experience but also elevate the system's performance in competitive scenarios. The journey of LifeLens, marked by continuous improvement and user-centered design, demonstrates our unwavering dedication to innovation and excellence in the field of UI design for lifelogging technology.

In future work, we plan to conduct a detailed analysis of lifelog systems to refine user interfaces and improve system performance metrics such as speed, accuracy, and reliability. This will include a specific investigation into how UI design affects system performance and identifying elements for optimization.

Moreover, while lifelogging technology has significant potential to improve quality of life, particularly in healthcare, its success is tied to increased social acceptance of wearable cameras. We will develop strategies to build public trust, focusing on transparent data policies and privacy controls.

Crucially, long-term support and maintenance will focus on user-driven improvements, with regular updates and adjustments informed by user feedback and UX testing. This approach will ensure the system remains relevant, and user-friendly.

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