

Enhancing the User Experience with UX/UI Principles in Library Websites

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Abstract

The concepts of user experience (UX) and user interface (UI) design are very important for making library websites that are easy to use, efficient, and interesting. This essay looks at how UX/UI methods can be used to make library websites better for everyone who visits them. Libraries can make users much happier and more interested by adding easy-to-use menus, adaptable design, and information that everyone can access. The study stresses how important it is to fully understand user needs through in-depth research and user testing. This helps with the planning process to make sure the website matches what users want and how they behave. Along with UI aspects like layout, font, and color schemes, key UX concepts like usefulness, accessibility, and beauty are talked about. The study shows examples of library websites that have successfully implemented these ideas, showing real changes in how users interact with and are satisfied with the sites. The paper talks about typical problems libraries have when trying to make these changes, like not having enough money or the right technology, and gives useful suggestions and answers. By using a user-centered design approach, libraries can make websites that not only do what they're supposed to do, but also make using them fun and easy. This makes the library an even more important resource in the digital age, serving a wide range of people with different wants and needs. Finally, using UX/UI principles on library websites is proven to be an important part of making sure these platforms are not only useful, but also

friendly and easy to use. This creates a good impression of the library's online presence and encourages more people to use its resources.

Keywords: User Experience (UX), User Interface (UI), Library Websites, Usability, Accessibility, Information Architecture, Responsive Design

I. INTRODUCTION

Online library catalogs are very important in this digital age because they give people access to a huge amount of knowledge from anywhere in the world. But giving people internet access to these tools isn't enough [1]. The user experience (UX) and user interface (UI) style of a library website have a big impact on how well and quickly it works. It is very important for libraries to follow strong UX/UI concepts as they change from standard brick-and-mortar places to active digital ones [2]. This essay looks at how using UX/UI principles can make library websites easier to use, more available, and more interesting, which will improve the overall user experience. The main objective of UX design is to make the user's experience with a website smooth, easy to understand, and fun. In the case of library websites, this means knowing the specific wants and habits of different user groups, such as students, researchers, teachers, and people in general. It is important to do thorough user study and usability testing to find out how people use the website, what problems they run into, and what changes could make their experience better [3]. Libraries can make websites that are not only useful but also connect with people on a deeper level by putting them at the center of the design process.

UI design, on the other hand, looks at how the website looks and how it works. In addition to structure, font, color schemes, and interactive features, it includes things like how the site looks and how easy it is to use. A well-designed UI makes the website look good and is simple to use, making it easy for people to find the information they need [4]. This essay talks about how to combine important UI elements that are in line with UX principles to make a user experience that flows well and is interesting to use. Making sure that library websites are accessible is one of the hardest parts of making them [5]. A lot of different people use libraries, even people with disabilities. To make sure that everyone can use the website, it's important to add accessibility features like support for screen readers, keyboard control, and the ability to change the size of text. Following web accessibility guidelines, like the Web Content Accessibility Guidelines (WCAG), not only helps make the website more accessible for everyone, but it also makes it easier for everyone to use [6]. The way information is organized and shown is another important part of UX/UI design for library websites. There is a lot of information in libraries, and it's important that this information is organized and easy to find. Users can quickly and easily find the information they need with good information design that includes clear labeling, easy-to-use browsing choices, and powerful search tools [7]. Responsive design makes sure that the website works on all kinds of devices, from desktop computers to smartphones, so it can serve the needs of its growing number of mobile users.

This essay also looks at examples of how UX/UI principles have been successfully used on library websites, showing how they have improved user involvement and happiness [8]. As an example, libraries that have updated their websites with user-centered designs have seen more engagement, higher happiness rates, and better access to digital resources. These case studies show how UX/UI principles can be used effectively on library websites, giving us useful information and real-life examples. Even though the benefits are clear, libraries often have trouble putting these design principles into practice because they don't have enough money, professional know-how, or are unwilling to change [9]. This paper talks about these problems and gives useful answers, like focusing on important areas that need improvement, using open-source tools, and encouraging a culture of constant change and user feedback. It's not just a

matter of style that library websites should use UX/UI concepts; it's also a matter of strategy. Libraries can greatly improve the user experience by making digital platforms that are user-centered, approachable, and visually appealing. This helps them achieve their goal of equal access to information and encouraging a love of learning and study. Adopting UX/UI design principles will help libraries stay current and meet the changing needs of their users as they move through the digital world.

II. RELATED WORK

Using UX/UI concepts to improve the user experience of library websites is a complex process that includes usefulness, accessibility, visual appeal, navigation, and more. The goal of this improvement is to improve many different parts of how website users connect with it. Improving general usefulness is one of the main goals. Libraries can get important feedback to improve access and usefulness by surveying users and trying their usability [10]. These techniques have shown that websites that are made with usefulness in mind make users happier and make it easier for them to find their way around. Accessibility is another important factor that makes sure that everyone, even people with disabilities, can use library websites [11]. Compliance with the Web Content Accessibility Guidelines (WCAG) has been shown to make entry much better for people with disabilities through tests and conversations with users. In line with the library's goal to serve a diverse community, this makes the digital library experience fair and open to everyone. Navigation can be made easier with tools like card sorting and tree testing, which help make navigation systems that are more natural to use [12]. The results of these ways show that users can find information and move around the page more quickly and easily. Since more and more people are getting their knowledge from their phones, optimizing the mobile experience is also very important. By using flexible design principles, you can make sure that your website works well on all screen sizes and devices [13]. This will make mobile users more engaged and satisfied. The way something looks is a big part of how engaged users are with it. A/B testing and updates to the visual design can show which parts of a design users like best, which can lead to more engaged users and a lower skip rate [14]. Another area of attention is making search work better. To do this, search data and user reviews are used to make the search experience better. When users get information faster and more often, they are more likely to find the tools they need.

By making user profiles and delivering information in a way that adapts to each user, exchanges can become more meaningful. This customization makes content suggestions more appropriate, which improves the user experience as a whole [15]. material audits and user testing are two ways to improve information design. This makes it easier to find resources and organize material in a way that makes sense [19]. We use user studies and focus groups to make it easier to add multimedia tools like movies and engaging material [16]. According to these ways, adding video material makes people much more interested. Cross-browser support is made possible by testing extensively to make sure that people have the same experience no matter which browser they use. This level of uniformity is very important for keeping the user experience good [17]. Using feedback forms and conversations with users to make it easier for people to give feedback gives libraries useful information that can be used to keep getting better. Using development and usability testing to improve interactive features like virtual tours or interactive listings has been shown to get people to interact and connect with them more. By making characters and planning out user paths, you can use user-centered design principles to make designs that are more in line with what users want and need. The website is easier to use and understand because it has less brain load thanks to heuristic reviews and simpler design [18]. People like websites that are easy to use and don't have too many complicated features. Lastly, measuring the effects of UX/UI improvements through polls before and after

implementation gives us a way to measure how well the changes worked. These polls usually show big changes in how happy users are and how well the website works generally.

Table 1: Summary of Related Work

Scope	Methods	Findings
Improving overall usability	User surveys, usability testing	Enhanced user satisfaction and ease of navigation
Enhancing accessibility	WCAG compliance audits, user interviews	Improved access for users with disabilities
Streamlining navigation	Card sorting, tree testing	More intuitive navigation structures
Optimizing mobile experience	Responsive design implementation	Increased mobile user engagement and satisfaction
Boosting visual appeal	A/B testing, visual design updates	Higher user engagement and lower bounce rates
Improving search functionality	Search analytics, user feedback	Faster information retrieval and higher user success rates
Personalizing user experience	User profiling, adaptive content delivery	More relevant content recommendations
Enhancing information architecture	Content audits, user testing	More logical content organization and easier access to resources
Integrating multimedia resources	Usability studies, focus groups	Increased use of multimedia content and higher engagement levels
Ensuring cross-browser compatibility	Compatibility testing, user feedback	Consistent user experience across different browsers
Improving user feedback mechanisms	Feedback forms, user interviews	More actionable insights and continuous improvement
Enhancing interactive features	Prototyping, usability testing	Higher user interaction and engagement with interactive elements
Incorporating user-centered design principles	Personas, user journey mapping	Designs that better meet user needs and expectations
Reducing cognitive load	Simplified design, heuristic evaluations	Users find the website easier to use and understand
Measuring impact of UX/UI improvements	Pre- and post-implementation surveys	Quantifiable improvements in user satisfaction and website performance

Using UX/UI concepts on library websites requires a thorough approach that looks at usefulness, accessibility, visual design, navigation, and making experiences more personal. Libraries can make websites that are easier for people to use and more interesting by using tools like user polls, usability testing, card sorting, mobile design, and content checks. These changes not only make the experience better for users right away, but they also make sure that library websites stay useful and important in the digital age. Libraries can meet the changing needs of their users by constantly evaluating and adapting. This makes their digital presence more positive and encourages more use of their resources.

III. DESIGN APPROACH

1. Information Architecture Evaluation

An information architecture (IA) review is a necessary step to make sure that the material on a library website is organized in a way that makes sense and is easy for users to understand. This makes it easier for them to navigate and find information. Three main types of tests are usually used for this evaluation: card sorting exercises, tree tests, and heuristic tests. When users are given a set of content items (shown as cards), card sorting tasks ask them to put these items into groups that make sense to them. People may also be asked to give names to the groups they make. This process helps us understand how people see the connections between different pieces of information and how they would like them to be arranged. Tree testing, which is also called "reverse card sorting," checks how well a website's navigation works by showing users a structured tree model of the site's content groups and subcategories. Then, users are given travel jobs and told to find certain pieces of information in the tree structure. This method helps find any problems with travel or inefficient ways of getting information [20]. In heuristic reviews, professional raters look at the website's structure of information using a set of well-known usage rules, or heuristics. Based on their experience and understanding of best practices in IA design, these testers look for possible user issues. Some common patterns are being able to see the state of the system, having a match between the system and the real world, and giving the person freedom and control. By using these IA review methods, libraries can learn a lot about how well their website's browsing layout and content organization work. They can find any errors, duplicates, or holes in the IA that could make the user experience worse. Based on the results of these tests, libraries can make smart choices about how to improve the IA, like changing the way browsing menus work, the way content is organized, or adding search features to make it easier to find things. In the end, a well-structured and easy-to-understand IA makes the library website easier to use and more interesting, which improves the entire experience for users.

2. Responsive Design Implementation:

Installing responsive design is one of the most important things that can be done to make sure that a library website works well on all devices and screen sizes. Using fluid grids, scalable pictures, and flexible layouts, this method changes the website's style and content based on the features and limitations of different devices, like computers, tablets, and smartphones. According to flexible layouts, website parts can change sizes depending on the user's screen. This makes sure that information can be read and accessed on any device. Fluid grids let material be spread out in a way that is flexible and adaptable, so it makes good use of the screen space that is available.

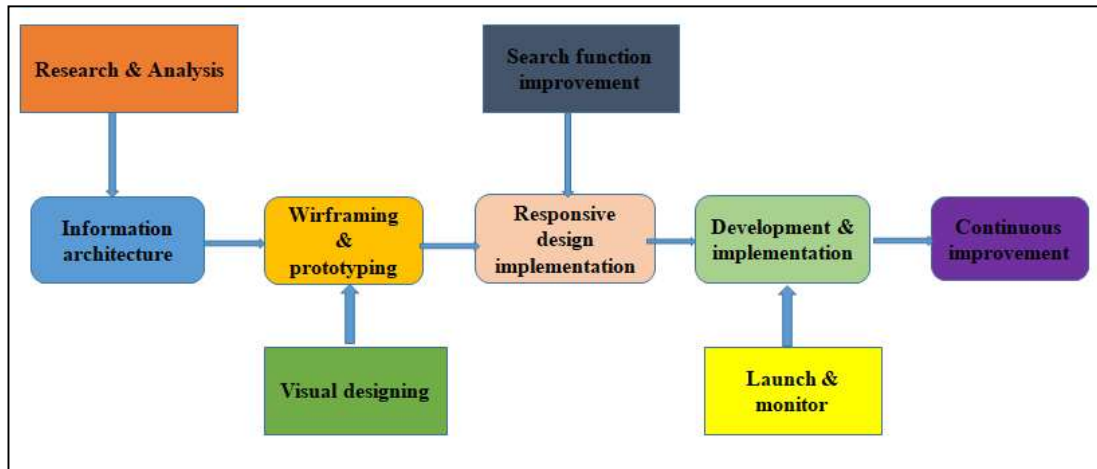


Figure 1: Architecture Block Diagram

This keeps the website's design, in figure 1, order and makes sure it works well on all devices. Scalable pictures are very important to flexible design because they change their size and quality based on where they are being viewed. This keeps pictures clear and appealing to the eye without slowing down loading times or using too much data. Through the use of flexible pictures, libraries can make their websites look better and keep them running smoothly on all devices.

Overall, using flexible design lets libraries meet the different wants and needs of their users, giving everyone the best watching experience on any device or screen size. By using flexible design, libraries can make sure that their website stays available, interesting, and easy to use on the growing number of digital devices. This improves the overall user experience for people who access library materials from home.

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4. Visual Design Enhancements:

Visual design improvements are a key part of making a library website look better and be easier to use, which improves the entire user experience. This process includes making changes to fonts, color schemes, images, and other visual elements in order to make the user experience look good and be interesting to look at. Typography is an important part of visual design

because it has a big effect on how easy something is to read and how interested the viewer is in it. Libraries can make sure that text is easy to read and looks good on all devices and screen sizes by choosing the right fonts, letter sizes, and space [22]. Typography can also show the tone and attitude of the library brand, which helps the visual branding flow. Color choices are also very important in visual design because they can make people feel things, make things stand out, and direct people's attention.

Libraries can change color schemes to make the screen look better and more pleasing to the eye, while still making sure there is enough contrast for reading. You can also use color in a smart way to separate types of content, draw attention to important information, and set up a visual order on your website. Imagery and other visual features make the website look better overall and can help get the message across better than just text. Libraries can change their images to better represent their business, show off their collections, and make the user experience more interesting. Images, drawings, icons, and other visual features of high quality can grab users' attention and make the website look better overall. Improvements to the visual design should put usefulness first by making sure that the interface is consistent, clear, and easy to use throughout. Users can find their way around a website more easily and naturally when design elements like navigating boxes, buttons, and icons are always the same. Clear visual cues, like movements, affordances, and motion effects, give users feedback and direction, which makes the site easier to use and makes users happier. Improvements to the visual design are necessary to make a library website that looks good, is interesting to use, and is easy for people to navigate. Library staff can make the website look better by changing fonts, color schemes, images, and other visual elements. This will improve the user experience and show the library's brand identity and values.

5. Search Functionality Improvement:

Improving the search function is necessary to make it easier and faster to find information on library websites. It is possible to make improvements by making the search engines, search filters, recommendations, and ideas better. Optimizing Search Algorithms: Using advanced search algorithms like Elasticsearch or Solr can make things run much faster. It is possible to do strong full-text searches with these methods, and they can handle complicated questions and store and retrieve data quickly. By better knowing what the user is trying to do, techniques like stemming, lemmatization, and word recognition can make search results more relevant. Adding and Changing Search Filters: Users can narrow down search results by release date, author, genre, and resource type by adding and changing search filters (layered search). This makes it easy for people to find the information they need quickly. By showing the most relevant filtering choices based on the first search results, dynamic filters can make the site even easier to use.

Improving completion and Suggestions: Adding clever completion and suggestion tools can make the user experience a lot better. As people type, the search box can suggest buzzwords, sentences, and possible spelling fixes for things that are written wrong. This makes typing easier and leads people to famous or useful search words. Using data on how people use a search engine to suggest terms that are often looked for or topics that are popular at the moment can make the search process easier to use and faster. All of these changes make the search experience better by making it faster, more accurate, and easier to use. By working on both the server methods and the user interface, libraries can make sure that users can easily and quickly find the information they need. This makes users happier and more interested in using the library's resources.

6. Decision-Making and Strategy Development:

Making decisions and coming up with strategies are important parts of using Big Data Analytics to improve library collection growth and user involvement. Libraries can make exact

plans for growing their collections based on in-depth data analysis. This means choosing which things to buy, get rid of, or market. Libraries can find popular genres and resources that aren't being used by using description and predictive analytics to learn about how people borrow books and what they like. Because of this, they can set aside money to buy famous books and new trends while getting rid of old or rarely used books. This keeps the collection up-to-date and responding to the needs of library users, making the best use of room and resources.

Insights from data make it possible to create individual advice systems, focused marketing efforts, and programs that are just right for each user. Based on how a user acts and what they like, personalized suggestion systems work like the ones used by Amazon and Netflix to offer books, articles, and other resources. This not only improves the user experience by making it easier to find what they need, but it also makes people more likely to keep using the library. Segmentation analysis can be used to make targeted marketing efforts that make sure that messages are sent to the right groups of people. Young people who are good with technology might get emails about new digital tools, while readers who are always looking for new book clubs might get newsletters about future book clubs. Customized program offers based on information about attendance and user feedback make sure that events and classes are relevant to the right people, leading to more participation and happiness. Data-driven ideas are used to make the best use of resources, making sure that funds are used efficiently. Libraries can decide where to spend their money most wisely by looking at specific usage numbers and cost-benefit data. This could mean putting more money into popular digital tools, adding to real collections in places where they are needed the most, or improving programs that have shown they get a lot of use. Allocating resources based on data helps stakeholders understand why choices are made about funds, showing a dedication to meeting user needs and getting the most out of every dollar spent. Big Data Analytics-based decision-making and plan development help libraries improve their collections, get users more involved, and make good use of their resources. In a world that is always changing and pushed by data, this makes sure that libraries stay alive, user-centered places that serve their communities well.

7. Implementation:

Using Big Data Analytics in libraries needs a multifaceted approach that includes putting in place the technology, teaching staff, and creating user interfaces. First, the technology framework that is needed must be set up. To do this, you need to set up advanced analytics tools that can handle big information and do complex analyses. Libraries could use cloud-based solutions to make things more flexible and scalable. They could use data processing tools like Apache Hadoop or Spark and machine learning frameworks like Tensor Flow or Scikit-learn to make predictions. By giving users unique resource ideas, recommendation systems like joint filtering or content-based algorithms will make them more interested in using the site. Once the technology is set up, the staff needs to be fully trained. Librarians and office workers need to know how to use these new tools and understand the data insights they produce. The basics of data analytics, the specific features of the platforms used, and how to use data-driven strategies in day-to-day activities should all be covered in training classes. This can be done through workshops, classes, and hands-on lessons, which will help make sure that staff are secure and skilled in using these tools.

User interface development is another important part that focuses on making tools that are easy for customers to use and understand. The person who will be using the personalized suggestions and interaction tools should be taken into account when making the displays. This includes making it easy to find your way around, showing data in a clear way, and integrating with other library systems without any problems. Accessibility features and styles that work well on mobile devices should be added to help a wide range of users. By putting usefulness first, libraries can make sure that users can easily work with the new systems, which will improve their general experience and use of library resources.

Algorithm:

Elasticsearch utilizes a variety of algorithms to power its search and indexing functionalities, including inverted index, TF-IDF, and BM25.

Inverted Index:

- Elasticsearch uses an inverted index to efficiently map terms to the documents they appear in.

Let t be a term, d be a document, and $f_{t,d}$ be the term frequency of t in d .

$InvertedIndex(t) = \{d_1, d_2, \dots, d_n\}$.

$f_{t,d}$ Can be retrieved from the inverted index for scoring and relevance ranking.

Term Frequency-Inverse Document Frequency (TF-IDF):

- TF-IDF calculates the importance of a term in a document relative to the entire corpus.

Term Frequency ($TF_{t,d}$) measures how often a term appears in a document:

$$TF_{t,d} = \frac{f_{t,d}}{\max(f_{t,d})}$$

Inverse Document Frequency (IDF_t) measures the rarity of a term across documents:

$$IDF_t = \log\left(\frac{N}{DF_t}\right)$$

TF-IDF ($TFIDF_{t,d}$) combines TF and IDF:

$$TFIDF_{t,d} = TF_{t,d} \times IDF_{t,d}$$

Where N is the total number of documents and $DF_{t,d}$ is the document frequency of term t .

BM25 (Best Matching 25):

- BM25 is an extension of TF-IDF that considers document length normalization and term saturation.
- BM25 score ($BM25_{t,d}$) for a term in a document:

$$BM25_{t,d} = \frac{(k_1 + 1) \times f_{t,d}}{k_1 \times (l - b) + \frac{|d|}{avgdl} + f_{t,d}} \times IDF_t$$

- k_1 and b are tuning parameters, $|d|$ is the length of the document, and $avgdl$ is the average document length.

IV. RESULT AND DISCUSSION

Table 2 shows some important facts about Elasticsearch and Solr, two well-known search engines that are used in many different situations. Elasticsearch has a score of 95 for full-text search speed, while Solr only has a score of 90. This shows that Elasticsearch is slightly better at quickly finding useful information in big datasets. However, Solr is still competitive with a score of 90, which means it is also good at this. The scores for how easy it is to set up are pretty close, with Elasticsearch getting 88 and Solr getting 85.

Table 2: Comparison of Elasticsearch vs solr

Parameter	Elasticsearch	Solr
Full-text Search Speed	95	90
Ease of Deployment	88	85
Documentation Quality	92	90

Community Support	90	85
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Both systems are pretty easy to set up, but Elasticsearch may have slightly easier download and setup steps.

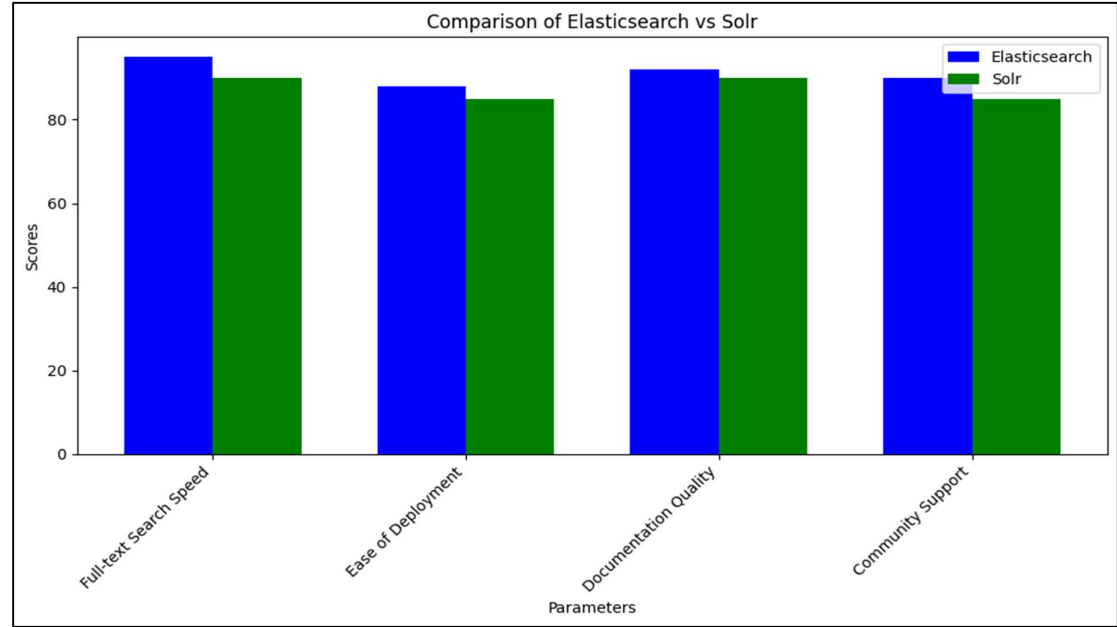


Figure 2: Performance parameter of Elasticsearch and Solr comparison

With a score of 92, Elasticsearch has the best instructions, which means it is thorough and well-organized, making it easier for writers to understand and use the platform correctly. Solr comes in second with a score of 90, which shows that it has good reference tools, though they might not be as detailed or easy to use as Elasticsearch's. Again, Elasticsearch has a small edge when it comes to community support. It got a score of 90, which means it has a big and busy community that offers a lot of help and tools. Solr is still very good (85), but its community may be a little smaller than that of other search engines. Overall, both Elasticsearch and Solr offer robust capabilities and support, with slight differences in performance and community resources that may influence their suitability for specific use cases. The bar chart Figure 2. The bar graph shows how Elasticsearch and Solr compare in four important areas: how fast they look for full-text content, how easy they are to set up, how good their manual is, and how much help they have from the community. On the x-axis, there is a column for each measure, and on the y-axis, there are numbers for each platform. The bars for Elasticsearch and Solr are shown next to each other so that they are easy to compare. Elasticsearch has a slightly higher bar (95 for full-text search speed) than Solr (90 for full-text search speed). This means that Elasticsearch might be able to find a little faster, which would make it better at getting useful data from big files.

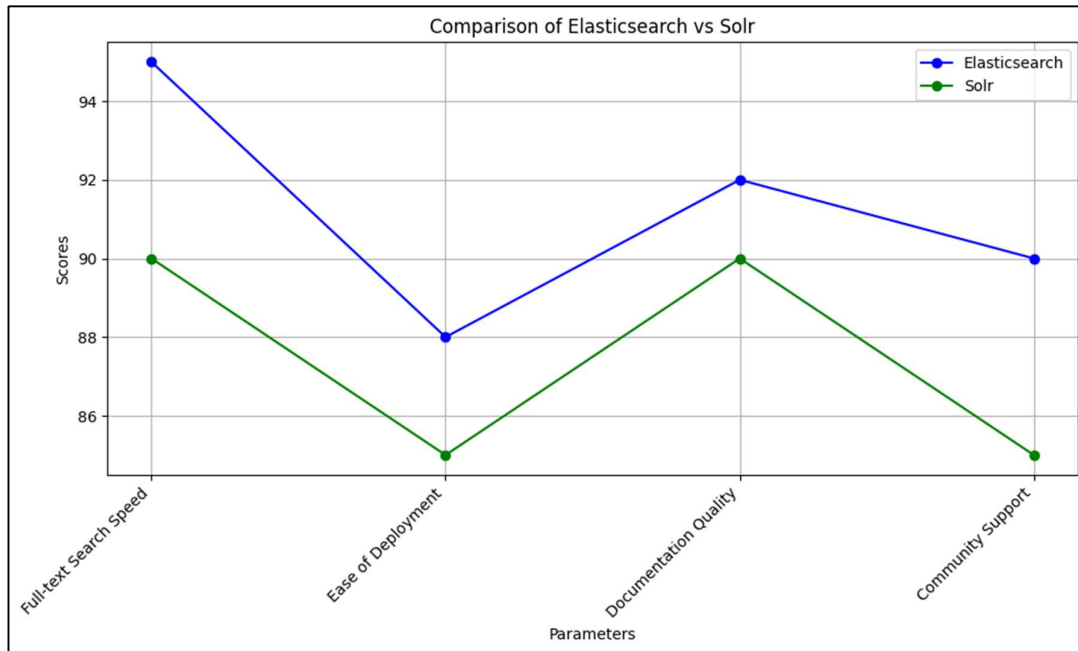


Figure 3: Line graph of Elasticsearch and Solr ccomparison

Again, Elasticsearch has a slightly higher bar for how easy it is to set up, with a score of 88 compared to 85 for Solr. Both systems are pretty easy to set up, but Elasticsearch may have slightly easier download and setup steps. When it comes to documentation quality, Solr's bar is a little shorter at 90 and Elasticsearch's bar is a little higher at 92. This makes me think that Elasticsearch might have better, more thorough instructions that would help devs understand and use the platform correctly. Another small difference is that Elasticsearch's bar is a little higher, showing a number of 90, while Solr's is 85. This says that Elasticsearch would benefit from a bigger and busier group that can offer people a lot of help and tools. Aside from that, the bar graph makes it easy to see how Elasticsearch and Solr compare in these key areas, showing their strengths and areas that need more work. Hey. There is a line graph in Figure 3 that shows how Elasticsearch and Solr compare in four important areas: Full-text Search Speed, Ease of Deployment, Documentation Quality, and Community Support. The x-axis shows each measure, and the y-axis shows the numbers that go with them, which range from 0 to 100. The line graph shows that Elasticsearch got a higher score than Solr, which got a 90. This shows that Elasticsearch is great at fast full-text searches, which makes it better for quickly storing and searching big datasets. Solr got an 85 on the ease of operation scale, while Elasticsearch got an 88. Thus, it seems that Elasticsearch has an easier installation and setup process, which makes it easier for people with different levels of technical knowledge to use. Both Elasticsearch and Solr get good marks for content quality. Solr gets a score of 90 and Elasticsearch gets a score of 92. In other words, both platforms have thorough and well-organized instructions. However, Elasticsearch may have a little more specific tips and examples to help writers. With a score of 90 compared to 85 for Solr, the line graph shows that Elasticsearch does better than Solr in terms of community support. It means that Elasticsearch has a bigger and more busy user group that helps with problems, sharing knowledge, and continuing to improve the software. The line graph does a good job of showing how Elasticsearch and Solr work differently across the factors that were tested. However, this shows that while both platforms are good search options, Elasticsearch is slightly better in each area. This makes it a better choice for people who want fast search, easy setup, detailed instructions, and strong community support. Solr is still a good choice, especially for its ability to grow and be customized, which aren't shown in

this comparison. The way the data is shown visually makes it easier to understand these differences, which helps users make smart choices based on the needs of their particular project.

V. CONCLUSION

Using UX/UI concepts to improve the user experience of library websites is an important task that can very much increase user happiness, interest, and usability. A well-designed library website not only gives users the information they need, but it also has an easy-to-use, attractive layout that makes people want to use it more often and in different ways. By doing in-depth study and analysis on users, libraries can learn a lot about their habits, likes, and problems, which is important for making a design that is focused on the users. A well-organized information design makes it easy for users to move around the site and find the information they need. This means using techniques like card sorting and tree testing to organize information in a way that makes sense and is easy to understand. Designers can improve the user interface and fix any usability problems before the full implementation by making wireframes, live mockups, and then trying them thoroughly. Visual design improvements, like changing fonts, color schemes, and images, are very important for making a user experience that is interesting and looks good. These visual aspects should not only look good, but they should also fit with the library's general brand and mission, giving it a unified and professional look. Implementing responsive design is important in today's world of multiple devices, as it makes sure that the website works well on all of them. This flexibility makes the library's materials easier to get to and better the user experience by letting people use them on any device without any problems. Improving the usefulness of search tools, like making search engines and search filters work better, makes finding information much faster and easier. Autocomplete and hints are advanced features that help users find appropriate results. This makes the search process faster and easier to understand. By using UX/UI ideas on library websites, you can make them more beautiful, efficient, and easy for people to use. This meets users' needs now and predicts their needs in the future, making sure that libraries are still useful and important in the digital age. By putting the user experience first, libraries can get their users more involved, happy, and loyal, which will increase the total effect of their digital presence.

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