# Phase II Project Deliverable

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***Abstract*— The paper describes the implementation of a simple web search engine. The project uses an Object-Oriented Analysis and Design. A prototype is built using an Object-Oriented Program. The scope of the paper is Phase II of the project.**

***Keywords—component, index***

## I. INTRODUCTION

The project's end goal is to create a system that will provide users with relevant information using the keywords entered by the user. The resulting data will be a sorted and filtered list of web page URLs to the end user. The major components of the search engine will include a search interface, indexing system, result filtering, query processing, etc. The search interface will allow the end user to interact with the system, enter search queries, and retrieve information. The indexing system will organize, store, and rank information to allow for a reasonably fast search. Result filtering will ensure that our system provides users with relevant, up-to-date data in sorted order. Finally, the query processing component of the project will be responsible for interpreting user inputs, identifying keywords in said input, performing index lookup, and retrieving results.

This document is the final project report. This document aims to explain our project's Unified Process and highlight all major project changes. It includes Use Case Diagrams, Sequence Diagrams, Class Diagrams, Package Diagrams, State Transition Diagrams, and Activity Diagrams for our Comet Crawler Web Search Engine.

### *A. Scope*

- This project strictly focuses on the Comet Crawler Search engine and its additional functions.
- The system comprises a search engine including a search interface, indexing system, result filtering, query processing, etc.
- All users can interact with the search engine interface, enter search parameters, perform searches, and redirect themselves to their desired result page.
- Only privileged Administrator users can add URLs, Modify the index, delete URL entries, and manage system settings.
- Privileged Administrator users must log in to ensure their credentials; only then will they be allowed to perform privileged operations.
- The system allows multiple users to search at the same time.

### *B. Assumptions*

The following assumptions constraints the Comet Crawler Search Engine:

- Because we are implementing a long-term-supported version of Ruby on Rails, we will be operating under the presumption that HTTP dispatching, database access, and other core functionality is handled appropriately. This design philosophy allows us to consider engineering the search algorithm and other important application-specific features.
- The application is dependent on Rails and its dependencies. A full list of requirements can be found at: **https://github.com/tyharg/CS-4376/blob/main/Gemfile**.

### *C. Project Unified Process (UP) / Road map*

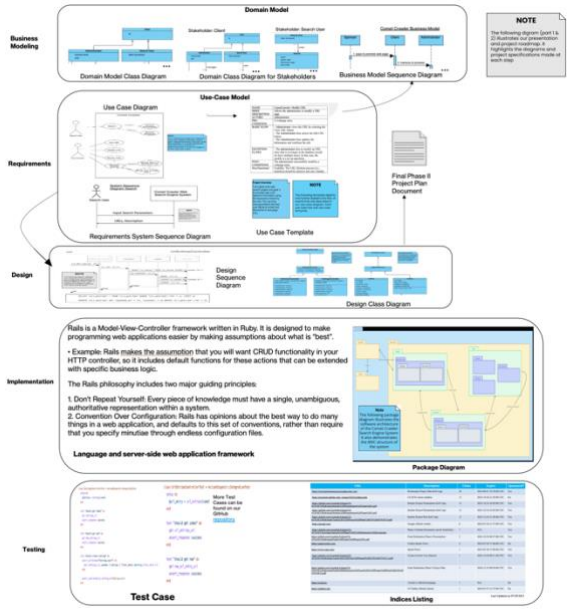


Fig. 1. The Comet Crawler System's Unified Process.

## II. MAIN BODY

### *A. Domain Modeling & Requirements Specifications*

#### A.1 Functional Requirements

1F. **Case-sensitive Search:** The system shall store and retrieve the input exactly as provided, preserving case sensitivity.

2F. **Hyperlink enforcement:** When a user clicks on a URL obtained from a query result, the system shall redirect the user to the corresponding website.

3F. **Specifying OR/AND/NOT Search**: The system shall allow users to specify the search mode (OR, AND, or NOT) for keyword-based searches.

4F. **Multiple search engines:** The system shall support the concurrent execution of multiple search engines.

5F. **Purging of out-of-date URLs and descriptions:** The system shall provide the functionality to delete outdated URLs and their corresponding descriptions from the database.

6F. **Query result listing options:** The system shall offer the ability to list query results in ascending alphabetical order, most frequently accessed order, or based on payment preferences.

7F. **Customizable result display and navigation:** The system shall allow users to set the number of results displayed per page and provide navigation functionality between pages.

8F. **Autofill with error correction:** The system shall automatically provide autofill suggestions while correcting typographical errors.

9F. **Symbol filtering based on user configuration:** The system shall filter out symbols that are not considered meaningful, according to user-configured settings.

10F. **Sponsored Web Entries with Priority Display:** The system shall allow web entries to be designated as sponsored if an advertiser has made a payment for promotional purposes. Sponsored URLs shall be given priority in the display of query results, ensuring they are shown prominently before non-sponsored entries.

11F. **Search Query Result List:** The system shall provide users with the ability to input a search query, and upon submission, generate and display a list of URL entries as the output, based on the search query.

12F. **Parsing and Filtering of User Input Queries:** The system shall parse user input queries to extract relevant keywords while ignoring specified filter characters. The extracted keywords shall be utilized to generate the resulting output list of URL entries.

13F. **URL Entry Management:** The system shall provide specific users with the ability to add, modify, delete, and promote URL entries. These privileged users shall have the necessary access and permissions to perform these actions on the URL entries within the system.

A.2 Non-Functional Requirements

1N. **Performance:** The Comet Crawler system shall provide fast and efficient search results, ensuring minimal response times even when handling many concurrent user requests.

2N. **Compatibility and Portability:** The Comet Crawler system shall be compatible with commonly used web browsers, ensuring proper functionality and consistent user experience across different browser versions. It should adhere to web standards and compatibility guidelines.

3N. **Usability:** The Comet Crawler system shall have a user-friendly interface, providing a seamless and intuitive search experience for users. It should be accessible across different devices and platforms.

4N. **Error Handling:** The Comet Crawler system shall implement comprehensive error-handling mechanisms to handle exceptions and provide informative error messages to users.

5N. **Reliability:** The Comet Crawler shall be highly reliable, providing consistent and uninterrupted search functionality to users. It should minimize system failures and errors, ensuring reliable access to search capabilities and delivering accurate results.

A.3 Comet Crawler Stakeholders

- **Administrators:** These are privileged users with the ability to add, delete, and modify URL entries. In addition to this, they also manage the system filtering and purging settings.
- **Client:** Are the ultimate owner of the project. This ownership allows them to specify project requirements, making them the recipients of project deliverables and the resulting product.
- **Sponsors:** These are the individuals that pay money to promote their websites to the top of the search result list. Stakeholders are the central piece of the business model as they bring monetary incentives for clients.
- **Search Users:** These are the individuals who interact with the Comet Crawler System. They will provide the search parameters and view the associated results. Sponsors will target these users.

A.4 Domain Model Diagrams

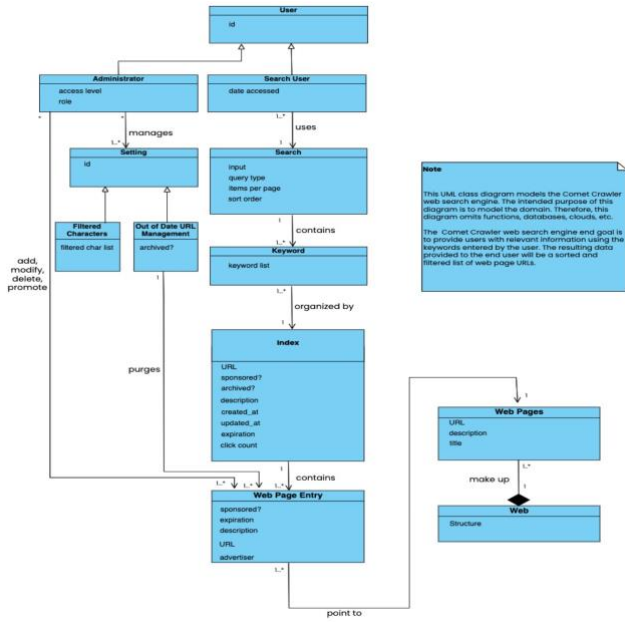


Fig. 2. Class Diagram for the Domain Model.

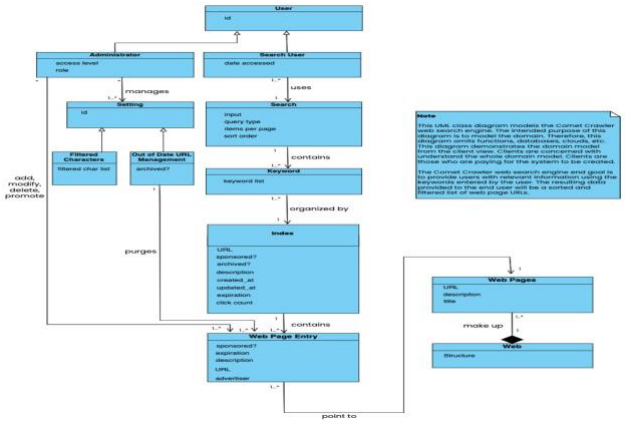


Fig. 3. Comet Crawler Web Search Engine System Class Diagram (Based on Client's View).

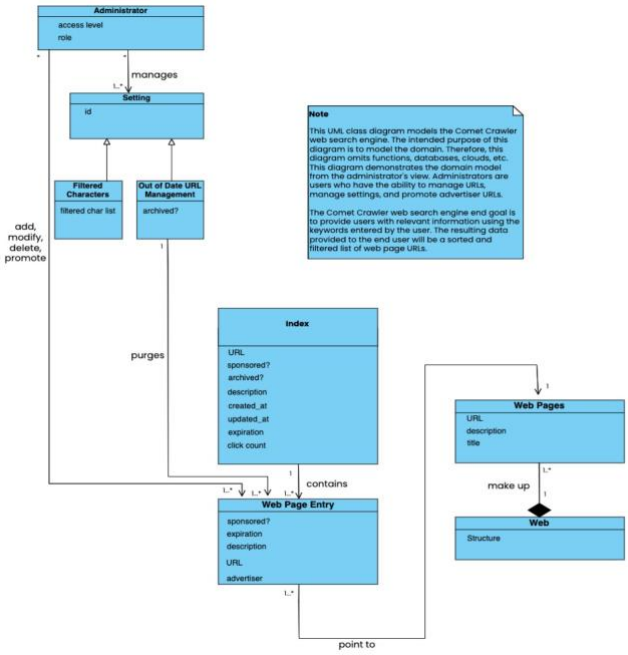


Fig. 4. Comet Crawler Web Search Engine System Class Diagram (Based on Administrator's View).

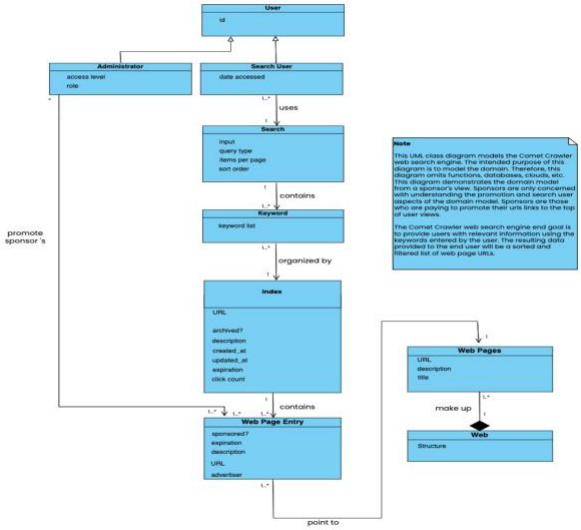


Fig. 5. Comet Crawler Web Search Engine System Class Diagram (Based on Sponsor's View).

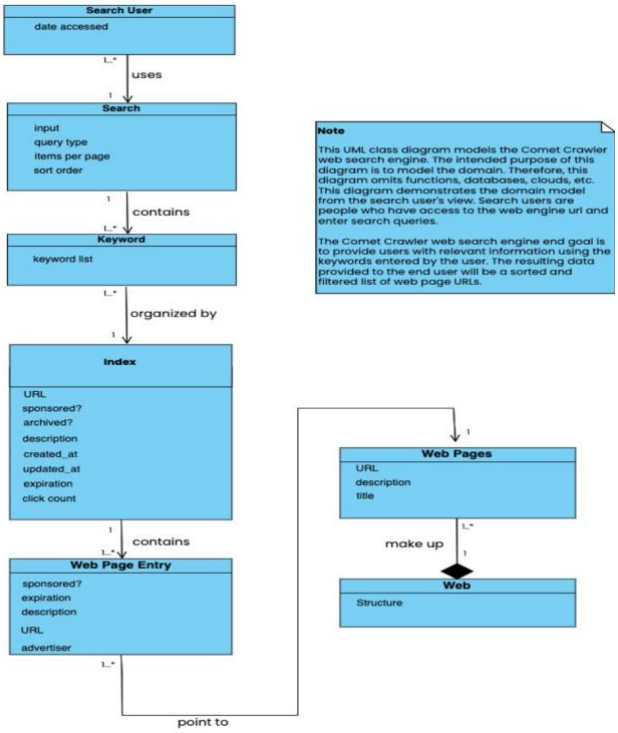


Fig. 6. Comet Crawler Web Search Engine System Class Diagram (Based on Search User's View).

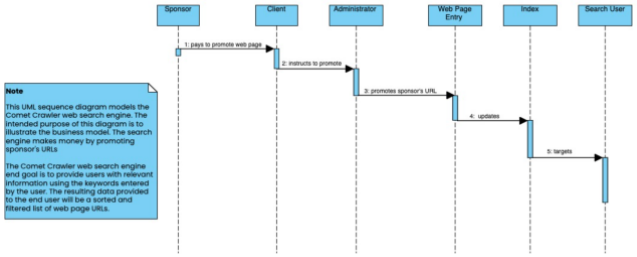


Fig. 7. Sequence Diagram to Model the Comet Crawler Web Search Engine's Business Model.

A.4 Requirements Specification Diagrams

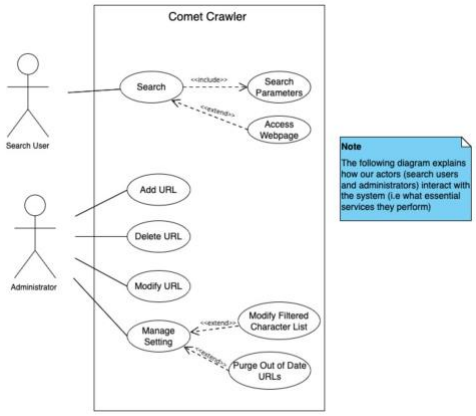


Fig. 8. Comet Crawler Web Search Engine System Use case diagram.

The Search User actors will enter search parameters to perform a search and have the option to click a URL from their search results list to redirect themselves to a different webpage. Administrator actors will add URLs, delete URLs, modify URLs, and manage system settings. It is assumed they have logged in before performing any such activities [1].

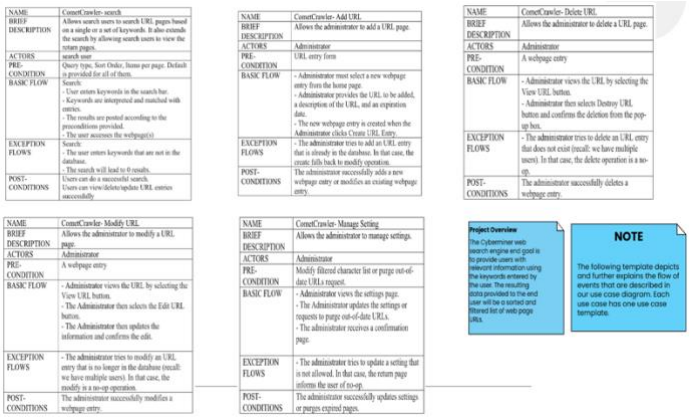


Fig. 9. Comet Crawler Web Search Engine System Use case templates.

A sequence diagram models the sequence of interactions (as time flows downward) to help understand and communicate how various system components cooperate to bring a use case functionality into fruition.

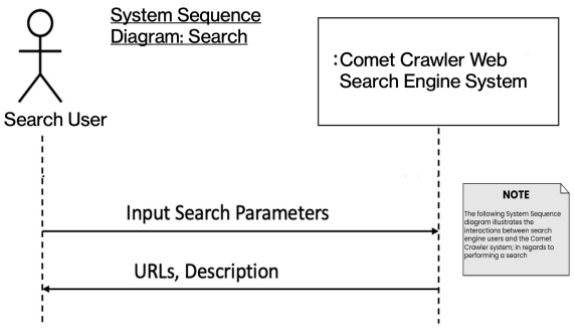


Fig. 10. Comet Crawler Web Search Engine System Sequence diagram for Search.

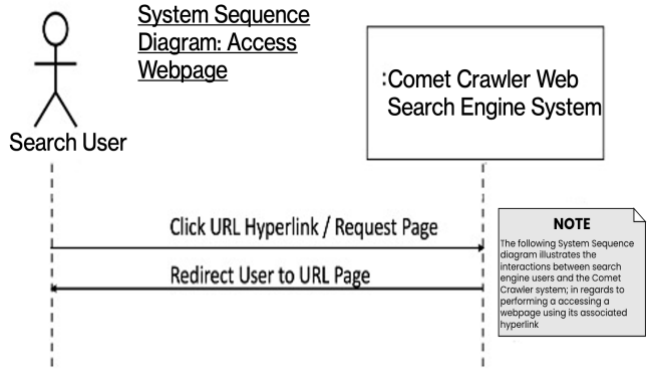


Fig. 10. Comet Crawler Web Search Engine System Sequence diagram for Accessing Web pages.

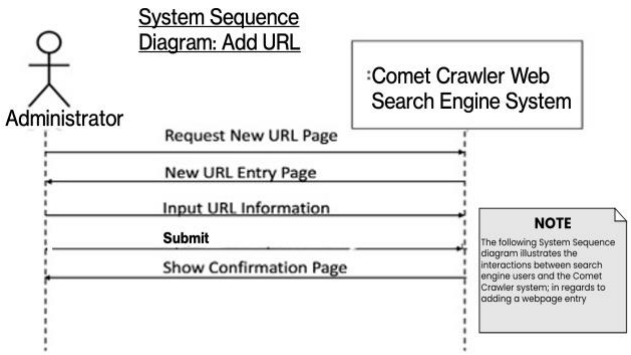


Fig. 11. Comet Crawler Web Search Engine System Sequence diagram for Adding URLs.

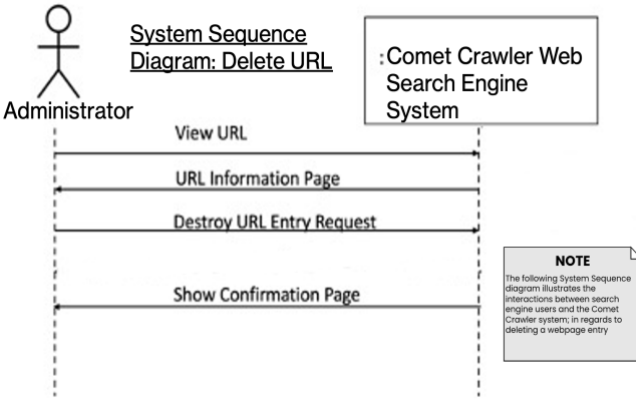


Fig. 12. Comet Crawler Web Search Engine System Sequence diagram for Deleting URLs.

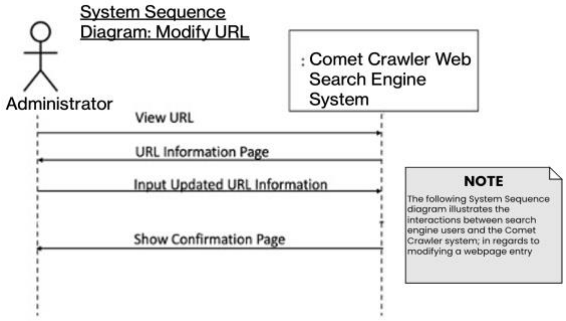


Fig. 13. Comet Crawler Web Search Engine System Sequence diagram for Modifying URLs.

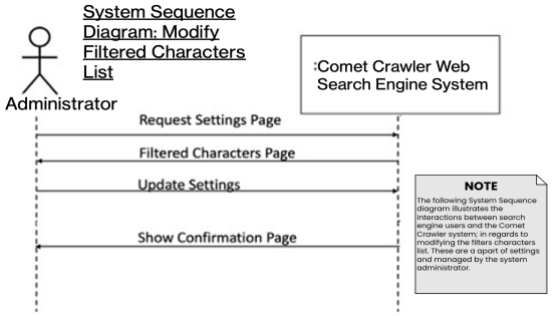


Fig. 14. Comet Crawler Web Search Engine System Sequence diagram for Modifying the System Setting's Filtered Characters List.

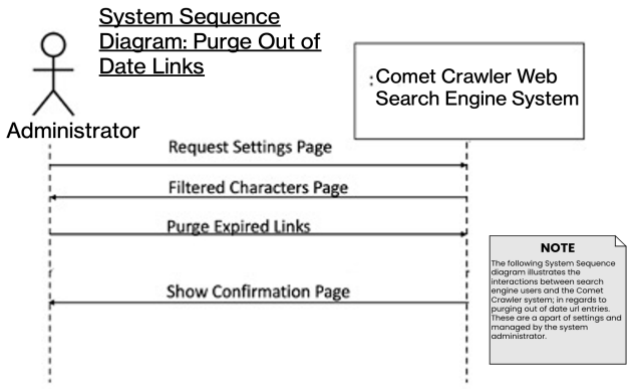


Fig. 15. Comet Crawler Web Search Engine System Sequence diagram for Purging Out of Date URLs.

## *B. Design Specifications*

B.1 Design Specification Diagrams

A class diagram provides a static view of the system's structure. It highlights key concepts from the problem and solution domain to better understand the structure of classes and how they interact. A class diagram shows classes, class attributes, class methods, and relationships between classes.

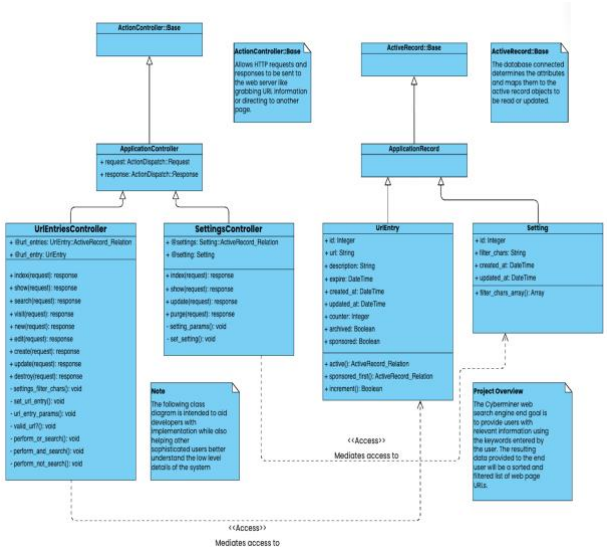


Fig. 16. Comet Crawler Web Search Engine System's Design Class Diagram.

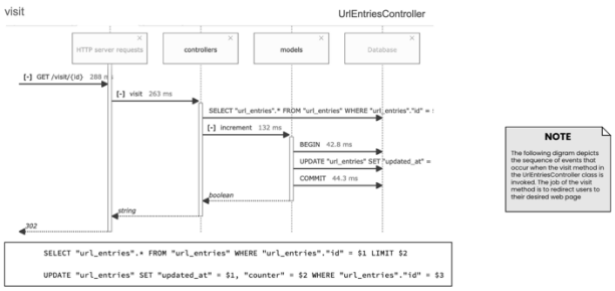


Fig. 17. Comet Crawler Web Search Engine Sequence diagram for visit function.

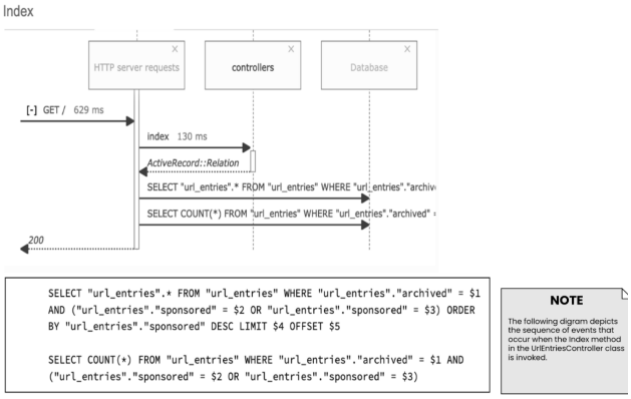


Fig. 18. Comet Crawler Web Search Engine Sequence diagram for the System's Index (Part of UrlEntriesController ).

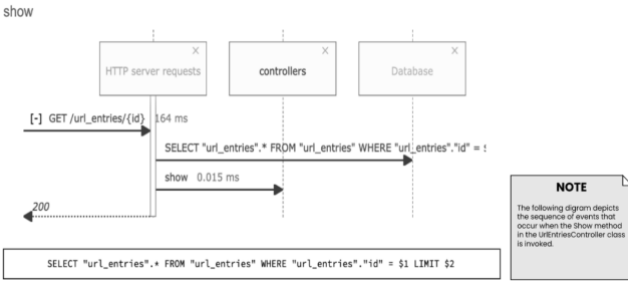


Fig. 19. Comet Crawler Web Search Engine Sequence diagram for the show function. (Part of UrlEntriesController ).

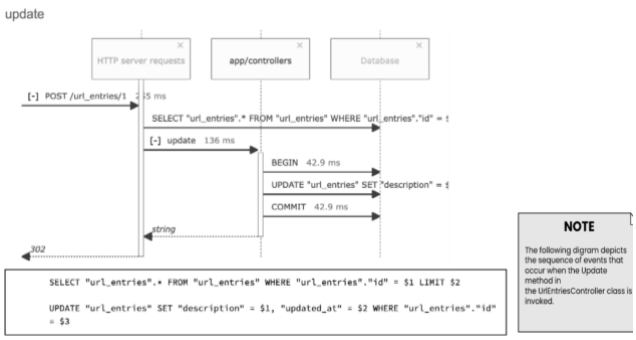


Fig. 20. Comet Crawler Web Search Engine Sequence diagram for the update function. (Part of UrlEntriesController)

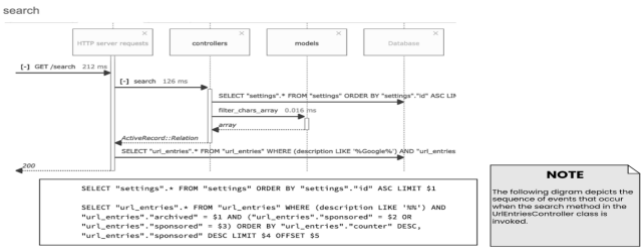


Fig. 21. Comet Crawler Web Search Engine Sequence diagram for the search function. (Part of UrlEntriesController ).


Fig. 22. Comet Crawler Web Search Engine Sequence diagram for the update function. (Part of UrlEntriesController)

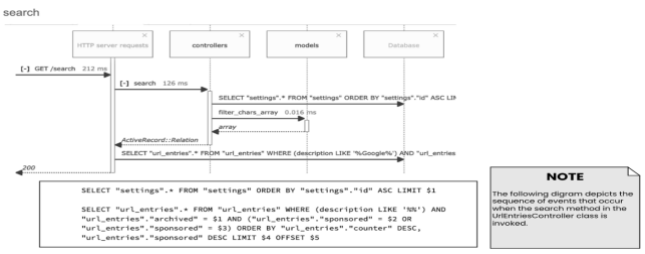


Fig. 23. Comet Crawler Web Search Engine Sequence diagram for the search function. (Part of UrlEntriesController )

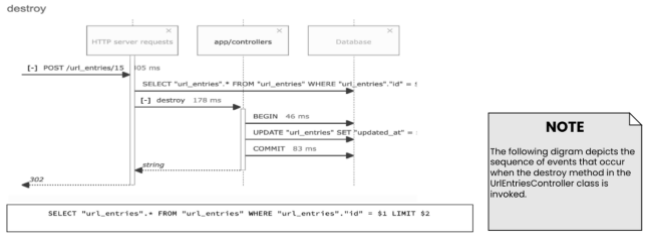


Fig. 24. Comet Crawler Web Search Engine Sequence diagram for the destroy function. (Part of UrlEntriesController)

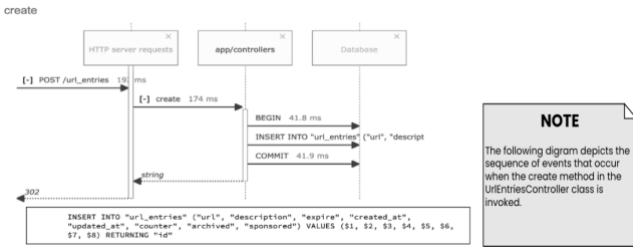


Fig. 25. Comet Crawler Web Search Engine Sequence diagram for the create function. (Part of UrlEntriesController )

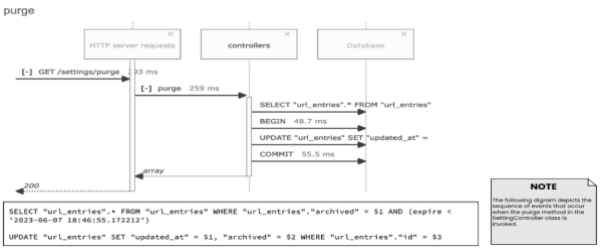


Fig. 26. Comet Crawler Web Search Engine Sequence diagram for the purging expired links function. (Part of SettingController)

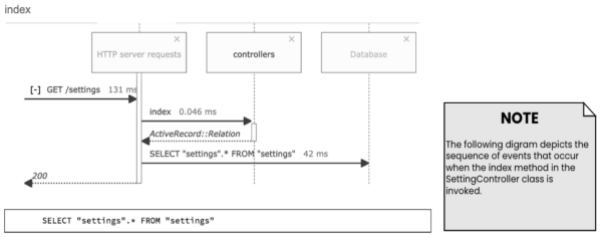


Fig. 27. Comet Crawler Web Search Engine Sequence diagram for the Setting's Index. (Part of SettingController)

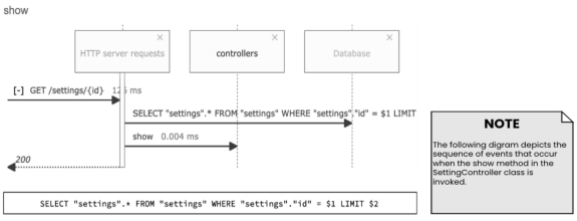


Fig. 28. Comet Crawler Web Search Engine Sequence diagram for the show settings function. (Part of SettingController)

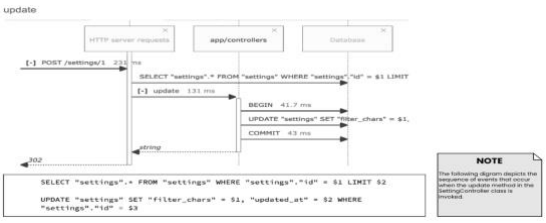


Fig. 29. Comet Crawler Web Search Engine Sequence diagram for the update settings function. (Part of SettingController)

## III. STATE CHARTS

### A. *Activity Diagrams*

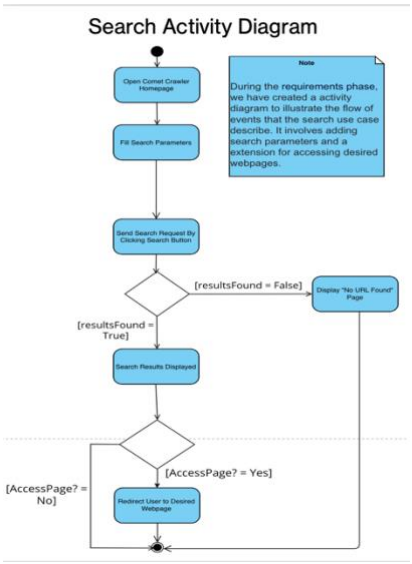


Fig. 30. Comet Crawler Web Search Engine System's Activity diagram to demonstrate the actions that are involved in a search.

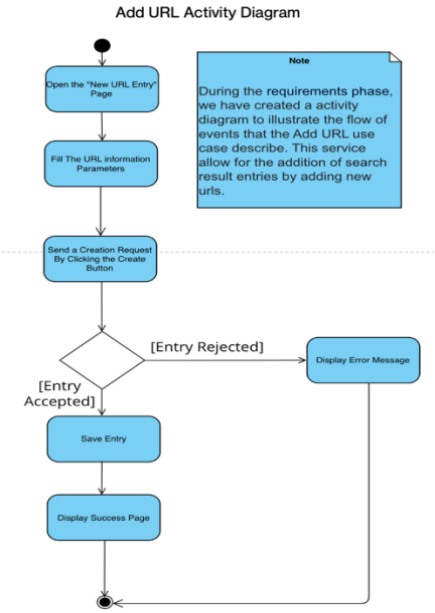


Fig. 31. Comet Crawler Web Search Engine System's Activity diagram to demonstrate the actions that are involved in adding a URL.

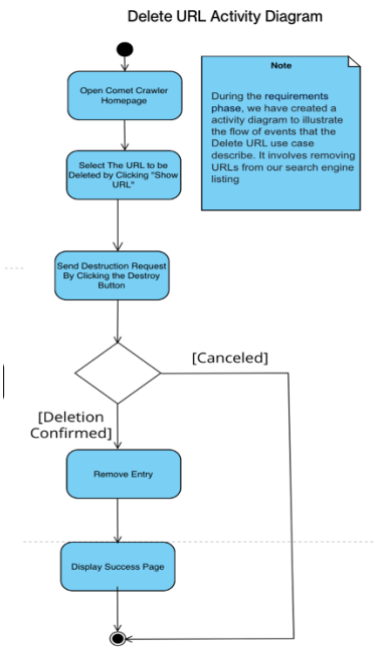


Fig. 32. Comet Crawler Web Search Engine System's Activity diagram to demonstrate the actions that are involved in deleting a URL.


Fig. 33. Comet Crawler Web Search Engine System's Activity diagram to demonstrate the actions that are involved in modifying a URL.

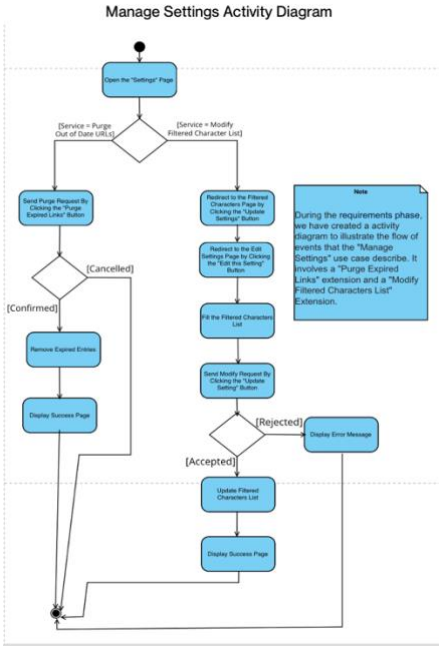


Fig. 34. Comet Crawler Web Search Engine System's Activity diagram to demonstrate the actions that are involved in managing the system's settings.

### *B. State Transition Diagrams*

State diagrams (also called state chart diagrams) model the state transitions a system will experience in its existence. This helps understand the behavioral aspects of the system.

We have two State diagrams: one to show the state transitions the system will go through with search user operations and one to show the state transitions the system will go through with administrator operations.

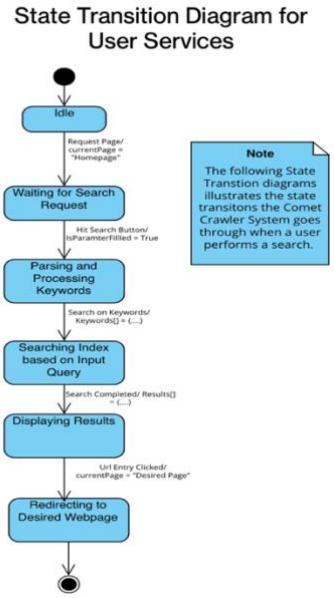


Fig. 35. State Diagram for User Services (Specifically Searching)

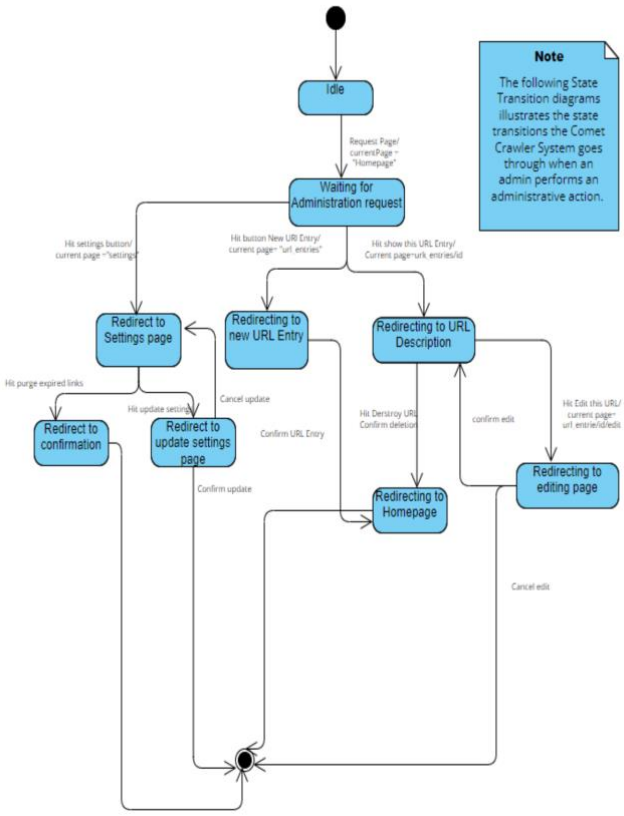


Fig. 36. State Diagram for Administrator Services (Add/Delete/Modify/Manage System Settings)

## IV. PROTOTYPE IMPLEMENTATION

The Prototype can be found here:

https://cs-4376-cyberminer.herokuapp.com/

### *A. Language and Server-side Web Application Framework*

Rails is a Model-View-Controller framework written in Ruby. It is designed to make programming web applications easier by making assumptions about what is "best" [2].

- Example: Rails assumes that you will want CRUD functionality in your HTTP controller, so it includes default functions for these actions that can be extended with specific business logic.

The Rails philosophy includes two major guiding principles:

- Don't Repeat Yourself: Every piece of knowledge must have a single, unambiguous, authoritative representation within a system.
- Convention Over Configuration: Rails has opinions about the best way to do many things in a web application, and defaults to this set of conventions, rather than requiring that you specify minutiae through endless configuration files.

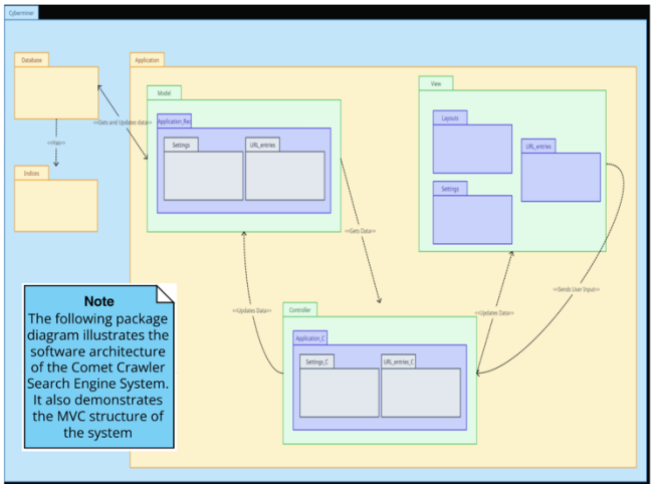


Fig. 37. Is a package diagram that illustrates how major groups of the system interact with one another. It specifically highlights the MVC architecture the project utilizes.

Package diagrams aim to communicate and model a system's architecture. It visualizes the grouping of components, classes, interfaces, etc., to present a high-level view of the system.

Developing a prototype for a Ruby on Rails search engine application requires a systematic approach with a focus on technical implementation and attention to best practices, alongside following conventions. Initially, defining the project's scope, identifying key features, and outlining the user experience are crucial steps. Selecting suitable gems and plugins to provide authentication and optimize search queries is essential. The application's core involves implementing search queries, input/view handling, and displaying search results with pagination, filters, and sorting options. A comprehensive test suite focusing on unit tests is vital to detect and resolve potential issues early in the development process. Additionally, our team focuses on requirements analysis and user input to give us insight for further refining the application. Based on feedback and search algorithm improvements, we can provide a platform where search functionality can be carried out, as well as handle future features to be integrated.

## V. TESTING

All our test cases can be found here: https://github.com/tyharg/CS-4376/tree/main/test


Fig. 38. Depicts a couple of our project test cases.

| URL | Description | Clicks | Expire | Sponsored? |
|---|---|---|---|---|
| https://team1preliminaryprojectplan.tiiny.site/ | Preliminary Project Plan Soft Copy | 29 | 2025-08-01 23:59:00 UTC | Yes |
| https://personal.utdallas.edu/~chung/OOD/syllabus.htm | CS 4376 course syllabus | 13 | 2023-10-20 21:59:00 UTC | No |
| https://github.com/Areebah-Fatima/CS-4376.0U1/blob/main/Interim%20Presentation%20Team%201.pdf | Interim Project Presentation Soft Copy | 12 | 2025-10-14 22:05:00 UTC | Yes |
| https://github.com/Areebah-Fatima/CS-4376.0U1/blob/main/Interim%20Presentation%20Team%201.pdf | Interim Project Presentation Soft Copy | 12 | 2025-10-14 22:05:00 UTC | Yes |
| https://github.com/Areebah-Fatima/CS-4376.0U1/blob/main/Team%201%20Project%20Plan%20(CS%204376.0U1).pdf | Interim Project Plan Soft Copy | 11 | 2025-12-25 21:58:00 UTC | Yes |
| https://google.com | Google official website | 8 | 2023-07-29 21:57:00 UTC | Yes |
| https://github.com/Areebah-Fatima/CS-4376.0U1/tree/main/Interim%20Phase%202%20Submission%20Documents | Phase 2 Interim Documents can be found here | 7 | N/A | Yes |
| https://github.com/Areebah-Fatima/CS-4376.0U1/blob/main/Final%20Project%20Phase%201.pdf | Final Submission Phase 1 Presentation | 3 | 2026-10-29 08:57:00 UTC | Yes |
| https://espncricinfo.com | Cricket Sports News | 2 | 2023-07-28 17:48:00 UTC | No |
| https://www.espn.com/ | Sports News | 1 | 2023-07-28 17:09:00 UTC | Yes |
| https://github.com/Areebah-Fatima/CS-4376.0U1/blob/main/Team%201%20User%20Manual%20(CS%204376.0U1).pdf | Comet Crawler User Manual | 1 | 2024-10-29 08:51:00 UTC | Yes |
| https://github.com/Areebah-Fatima/CS-4376.0U1/blob/main/Final%20Submission%20Team%201%20Project%20Plan%20(CS%204376.0U1).pdf | Final Submission Phase 1 Project Plan | 1 | 2024-12-19 08:58:00 UTC | Yes |
| https://twitch.tv | Twitch.tv official homepage | 1 | N/A | No |
| https://utdallas.edu | UT Dallas official website | 1 | 2023-07-27 21:57:00 UTC | No |

Fig. 39. Shows a listing of our indices content. This list was last updated on 07/29/2023.

## VI. User Manual

The Phase II User Manual can be found here: User Manual

**Comet Crawler Web Search Engine User Manual**

Software Manual, July 2023

Authors:
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Darrien Kramer

Fig. 40. Illustrates the title page of our User Manual.

**CONTENTS**



Fig. 41. Illustrates our User Manual's Table of Contents.

# 1
# ACCESSING THE SEARCH ENGINE SYSTEM

***How to Access the Website Through a Hyperlink***

Step 1: Hover your mouse over the following link, which is underlined and highlighted in blue.

Search Engine Web Page URL: https://cs-4376-cyberminer.herokuapp.com/


Figure 1.1 When you have successfully hovered your mouse point over the hyperlink, it should look like this.

Step 2: Once your mouse point is hovering over the link, press your mouse to click the link.

Step 3: Viola, you have found your way to the Comet Crawler Search Engine Web Page

Fig. 42. Shows the steps to access the Comet Crawler Webpage


Figure 1.2 The following image illustrates the Comet Crawler Web Search Engine homepage.

***How to Access the Website Through a Web Browser Window***

Step 1: Open a browser window of your choice.

Figure 1.3 The following image illustrates a Safari web browser window.

Step 2: Click the textbox located at the top of your preferred browser window. It might be labeled with a command such as "Search or enter a website name."

Step 3: Type the following into your search box: https://cs-4376-cyberminer.herokuapp.com/.

Step 4: Once you hit enter or click the search icon, you should be redirected to the Comet Crawler web search homepage.

Fig. 43. Shows the alternative steps to access the Comet Crawler Webpage

## 2
## STEP BY STEP USER FUNCTIONS

***How to Carry Out a Search***

Note: If you have not yet opened the Comet Crawler Homepage, please follow the instructions in Section 1 of this user manual.

Step 1: Hover your mouse point over the search bar. Click the search bar and type in your search query. Note: while typing, you may notice some autofill options. If one matches what you're looking for, click on it. Otherwise, finish typing in your search query and click to close the box.


Figure 2.1 The following highlights how to hover your mouse point over the search bar.


Figure 2.2 The following image illustrates the autofill feature.

Fig. 44. Aims to teach System users how to search the Comet Crawler Webpage.

Step 2: Click each drop-down box and specify your search parameters.

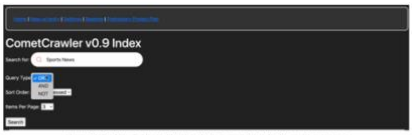


Figure 2.3 The following image illustrates the drop-down boxes for the search parameters.

Step 3: Click the grey box labeled search once you have specified all your search parameters. This should redirect you to the search result page, which will be filled with all the relevant search URLs found in our index.


Figure 2.4 The following image illustrates the search result page.

***How to View Information About a URL Entry***

Note: If you have yet to log in, the following functions will not be fully available. Please follow the instructions in Section 3 of this user manual.

Step 1: Once you have located your desired URL entry, click the blue underlined link named "Show this URL entry." This should redirect you to the URL information Page.

Fig. 45. Continues to teach System users how to search the Comet Crawler Webpage.

Figure 3.7 The following image illustrates how the URL information page will look like for regular search users.

Step 2: To return to the website's homepage, click the blue underlined link labeled "Home" in the page header.

## 3
## STEP BY STEP ADMINISTRATOR FUNCTIONS

***How to Create an Administrator Account***

Note: If you have not yet opened the Comet Crawler Homepage, please follow the instructions in Section 1 of this user manual.

Step 1: On the Comet Crawler Homepage, you will see a grey "Sign in" button at the top of the webpage, located in the header. Click this button to be redirected to the sign in page.

Fig. 46. Instructs how to create a privileged account.


Figure 3.1 The following image illustrates how to get to the sign in page.

Step 2: Click the blue underlined "Sign up" hyperlink underneath the log-in button to be redirected to the create account page.

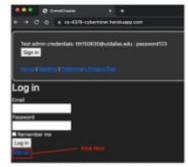


Figure 3.2 The following image illustrates how to get to the sign-up page.

Step 3: Hover your mouse point over the text box (located under the "Email" label) and type in your account-associated email. Repeat the same steps for entering the password and password confirmation (Make Sure They Match!).

Fig. 47. Further illustrates how to create a privileged account.

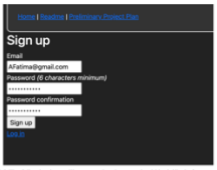


Figure 3.3 The following image illustrates what the page should look like before you sign up.

Step 4: Click the grey button labeled "Sign Up," and Viola, you have created an administrator account and been granted access to privileged functionalities.

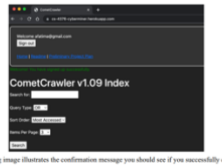


Figure 3.4 The following image illustrates the confirmation message you should see if you successfully created your account.

***How to Log In***

Note: If you have not yet opened the Comet Crawler Homepage, please follow the instructions in Section 1 of this user manual. If you have not yet created an administrator account, please follow the steps in section 3.

Fig. 48. Depicts the steps a user would have to take to log in to their administrator account.

Step 1: On the Comet Crawler Homepage, you will see a grey "Sign in" button at the top of the webpage, located in the header. Click this button to be redirected to the sign-in page.


Figure 3.5 The following image illustrates how to get to the sign in page.

Step 2: Hover your mouse point over the text box (located under the "Email" label) and type in your account-associated email. Repeat the same steps for entering the password. Note: if you want your credentials to be saved, click the "Remember me" box.

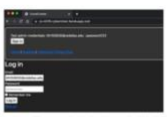


Figure 3.6 The following image illustrates what the log in page should look like before you sign in.

Step 3: Click the grey button labeled "Log in," and Viola, you have logged in to your administrator account and been granted access to privileged functionalities.

***How to View Information About a URL Entry***

Fig. 49. Illustrate the steps a user would have to take to view all the information associated with a URL entry.

Note: If you have yet to log in, the following functions will not be fully available. Please follow the instructions in Section 3 of this user manual.

Step 1: Once you have located your desired URL entry, click the blue underlined link named "Show this URL entry." This should redirect you to the URL information Page.

Figure 3.7 The following image illustrates how the URL information page will look like for administrators.

Step 2: To return to the website's homepage, click the blue underlined link labeled "Back to URL entries."

***How to Edit / Delete a URL Entry***

Note: If you have yet to log in, the following functions will not be available. Please follow the instructions in Section 3 of this user manual. Also, if you have not yet opened the URL's entries information page, please follow the instructions in Section 3 of this user manual to do so.

Steps to delete a URL entry:

1. Open the URL entry information page. Steps to do this have been highlighted in section 3 of this manual.
2. Click the grey button labeled "Destroy this url entry."
3. If a message appears at the top of your browser window, click ok to continue the deletion process. When done correctly, you should see a confirmation message.

Fig. 50. Shows how to edit or delete a URL entry.


Figure 3.8 The following image illustrates the confirmation page.

Steps to modify a URL entry:

1. Open the URL entry information page. Steps to do this have been highlighted in section 3 of this manual.
2. Click on the blue-underlined link labeled "Edit this url entry."
3. You should see the following page:


Figure 3.9 The following image illustrates the modifying URL entry parameters.

Please modify all the necessary parameters and click the grey "Update URL entry" button when finished.

Fig. 51. Shows how to access the Edit URL page and modify a URL entry.

4. When done correctly, you should receive the following confirmation message.

Figure 3.10 The following image illustrates the confirmation page.

***How to Create a URL Entry***

Note: If you have yet to log in, the following functions will not be available. Please follow the instructions in Section 3 of this user manual.

Steps to Create a URL Entry:

1. Click the blue-underlined link labeled "New url entry" located in the Comet Crawler Homepage Header. This should redirect you to a page that looks like Figure 2.8.


Figure 3.11 The following image illustrates the New URL entry Page.

VII.

Fig. 52. Shows how to create a new URL entry.

2. Fill out all the parameters listed on the web page. For unsponsored URLs, keep the "Paid Sponsor" box unchecked.
3. When done correctly, you should see a confirmation message telling you your URL entry has been created.

***How to Modify the Filtered Character's List***

Note: If you have yet to log in, the following functions will not be available. Please follow the instructions in Section 3 of this user manual.

Steps to Modify the Filtered Character's List:

1. Click the blue-underlined "Settings" link in the Comet Crawler Homepage Header. This should redirect you to a page that looks like Figure 3.12.


Figure 3.12 The following image illustrates the Settings Page.

2. the blue-underlined "Update Settings" link to modify the filtered characters list.
3. You should be led to a page like the one shown in Figure 3.13. Click the blue-underlined link labeled "edit this setting" and type in the new filtered characters list.

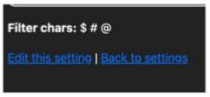


Figure 3.13 The following image illustrates the edit settings Page.

Fig. 53. Illustrates how to access the Settings page to manage the filtered character list.

4. After editing the filtered characters list, click the grey "Update Setting" button. You should see a confirmation message that the list has been modified when done correctly.

***How to Purge All Out-of-Date URLs***

Note: If you have yet to log in, the following functions will not be available. Please follow the instructions in Section 3 of this user manual.

Steps to Purge all out-of-date URLs:

1. Click the blue-underlined "Settings" link in the Comet Crawler Homepage Header. This should redirect you to a page that looks like Figure 3.12.
1. Click the blue-underlined link labeled "Purge Expired Links" to delete out-of-date URL entries.
2. If a message pops up at the top of your browser window, click ok to continue the deletion process. When done correctly, you should see a confirmation message.

Fig. 54. Shows how to purge expired links to keep search results as relevant as possible.

## VIII. GLOSSARY

### *A.*

### *B. Definitions*

**Component** Is a basic building block of a system that provides some form of functionality. Identifying key components and component relationships is a fundamental part of the design stage.

**Index** Is the data structure that stores and organizes the data about URL entries and web pages.

### *C. Abbreviations*

**CI/CD** Continuous Integration / Continuous Delivery

**MVC** Model-View-Controller

**UML** Unified Modeling Language

## REFERENCES


[1] G. BOOCH, *Unified Modeling Language User Guide*. ADDISON-WESLEY, 2017.

[2] S. Holzner, Beginning Ruby on Rails. Indianapolis: Wrox, 200