Software Requirements Specification
for the
Semantic Web Crawler
30 April 2012
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Revision Changes

The revision change record shall contain the revision number, date of revision, engineering change order (ECO) number, description of what was modified, added or deleted, and the individual's name responsible for the change.

Revision Change Record

Revision Number	Revision Date	ECO Number	Description of Change	Author
0	29-Mar-2012		Original	Manager/Leaders

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1.0 Introduction

This document comprises the System Requirements Specification (SRS) for development of the Semantic Web Crawler (SWC). The SRS is the controlling document for managing and maintaining the software project and defines the technical approach and specifications necessary to satisfy the project requirements. Specifically the following subsections describe the purpose, definitions, acronyms, abbreviations, references, and an overview of the Semantic Web Crawler System Requirements Specification.

1.1 Purpose

The purpose of this SRS is to present the initial requirements for the SWC program including basic operations of the system and general expectations for the product. The SWC program is being developed to respond to the need for a software program that allows a person or business to quickly and easily scan a web page for vital data and information anywhere on the web quickly and easily while allowing for speed and accuracy in the process through integration of existing Commercial Off-The-Shelf (COTS) products. The intended audience for this SRS consists of:

- The SWC program system development team
- Senior management
- The current customer (Professor Dr. Jeffery Appel)

The objective of this document is to provide a comprehensive description of the software objectives, define unfamiliar terms and make reference to additional documents which may provide further background where needed.

1.2 Scope

The SWC program is intended for use by personal and business users who are trying to crawl a specific webpage or group of sites for specific types of data that they have a need for. The core of the crawler shall handle the crawling and parsing function outside the view of what the user sees. The product shall provide a user friendly and highly efficient interface between the user and the systems to be monitored and programmed for automated control from virtually any location on a cloud platform.

Creation of this capability with state of the art software shall provide far greater flexibility and efficiency in the user interface (UI) function development and supporting software development plus expanded opportunities to develop follow on capabilities to meet future needs and opportunities.

1.2.1 Software Products

The SWC program shall consist of software and documentation for installation on the customer's servers. The software packages shall include security and administration applications, Graphic User Interface (GUI) applications and database functions necessary to support the overall

product. The software shall be delivered in a format that facilitates loading and implementation. The SWC program shall build on existing capabilities that include the host server's Linux Operating System (OS), hardware interfaces, client/server architecture, and the Internet. Program development for operating systems other than Linux shall occur during the program enhancement phase. Existing commercial and non-commercial software applications shall be evaluated for possible use and integrated into the new system where feasible. Original code shall be developed to augment COTS software where required to achieve an interface.

1.2.2 Capabilities

The SWC program shall provide the customer with the following:

- Hypertext Transfer Protocol (HTTP)/Hypertext Transfer Protocol with Secure Sockets Layer (HTTPS) crawler.
- Input/Output (I/O) Operations.
- Content Storage.
- Hypertext Markup Language (HTML) & Data Parser.
- Database Management.
- User Interface.

The program shall operate on the existing operating system and utilize existing hardware, client/server architecture and network communications.

1.2.3 Application

The software being provided shall encompass crawler instances made available upon login. The instances shall provide users with the capability to monitor, control, and program automatic operation of various sites and what data shall be crawled as well as when. These applications shall make maximum use of COTS products. Use of COTS shall both minimize cost and minimize training requirements and enhance the ability to provide a unified user environment in place at minimal cost. The goal is to rapidly develop a prototype in order to clarify the requirements and project scope and then proceed to the full capability products. Development of an enhanced version is envisioned for the future to take full advantage of evolving capabilities.

1.3 Glossary

1.3.1 Definitions

Cache	A location used to store data in order to have faster subsequent retrievals
Cloud Based Environment	Refers to applications and services offered over the Internet. Data Centers that offer services are referred to as the *cloud*
De-couple	Two or more systems that are able to transact without being

	connected (coupled). The systems do not interact with each other and a decoupled system allows changes to be made to any one system without having an effect on any other system
Encapsulate	The process of combining elements to create a new entity
Module	A self-contained hardware or software component that interacts with a larger system
MySQL Database	A Relational Database Management System that runs as a server to provide multi-client access to a number of databases
S3	A simple storage service

1.3.2 Abbreviations and Acronyms

AWS	Amazon Web Service
COTS	Commercial Off-The-Shelf
CSV	Comma Separated Values
DNS	Domain Name Service
DSL	Digital Subscriber Line
ECO	Engineering Change Order
GUI	Graphical User Interface
HTML	Hypertext Markup Language
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol with Secure Sockets Layer
I/O	Input/Output
IP	Internet Protocol
ISP	Internet Service Provider
KLOC	Thousand Lines of Code
GHz	Gigahertz
GB	Gigabytes
MTBF	Mean time between failure
MTTR	Mean time to repair
OS	Operating System
PC	Personal Computer
RAM	Random Access Memory
RDS	Relational Database Service
SRS	Software Requirements Specification
SQL	Structured Query Language
SWC	Semantic Web Crawler
TCP	Transmission Control Protocol
UI	User Interface

1.4 References

Bastos, M., Covarrubias, M., Patel, D., Semantic Web Crawler Operational Concept Document March 2012

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1.5 Overview

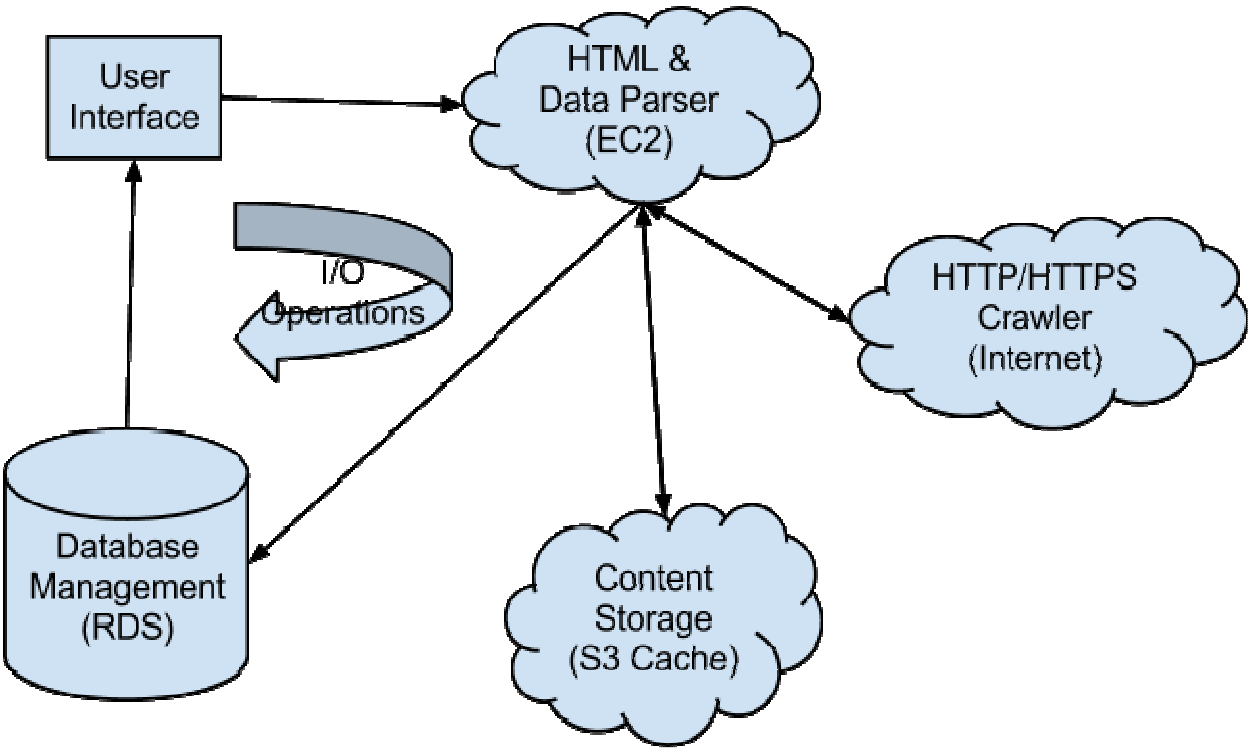
The SWC SRS provides an overall description of the product consisting of a high-level perspective of its functionality, users, and constraints, including the assumptions implicit in the design, and the specific description of the system's operation. The SRS is organized as follows:

- Section 2.0 provides a high-level perspective as to the design concept, product functions, the system users, constraints affecting requirements, assumptions and dependencies and requirements subsets.
- Section 2.1 describes the relationship of the SWC product with other systems and devices.
- Section 2.2 summarizes the major functions of the SWC software.
- Section 2.3 describes the general characteristics and anticipated capabilities of the users with respect to their ability to utilize the SWC product. These characteristics define the level of complexity that the software must be designed to meet.
- Section 2.4 presents the operations that are involved in the SWC functions. These operations are the factors that constrain the types of hardware and software that are required to accomplish the tasks assigned to the product.
- Section 2.5 describes the assumptions on which the SWC software shall be developed. These include capabilities and limitations of interfacing devices.
- Section 2.6 describes the capabilities that have been deferred to a subsequent development effort.
- Section 3.0 provides a detailed specification of all system requirements to a level of detail that shall enable designers to design the system that meets the requirements and testers to test that the system fulfills those requirements.
- Section 3.1 defines the boundaries of the system and its interfaces.
- Section 3.2 discusses the memory requirements for various possible applications such as the impact of the crawl itself.
- Section 3.3 summarizes any site specific requirements to support the SWC software.
- Section 3.4 is a use case analysis of each functional requirement.

2.0 Overall Description

This section describes the general factors that affect the Semantic Web Crawler program product and its requirements. It provides the background against which the system requirements have been defined and the rational used in the system design. See Figure 2.1.

FIGURE 2.1 SWC FLOW DIAGRAM



2.1 Product Perspective

The Semantic Web Crawler program provides the user with an environment to monitor, control and program control of requirements that are input by the end user. The program is designed to operate in the background and handle crawling operations by reaching out to cloud environments for more resources. Access to program functions when the program is in operation, is accomplished through user login directly on the host computer or remotely through the Internet. Successful login, with the User Name and password protection, shall implement the application in the mode for which the User Name provides privileges.

2.1.1 Memory Constraints

2.1.1.1 Primary Memory

2 Gigabytes (GB) of Random Access Memory (RAM) for operating system.

2.1.2 Operations

The operations provided by the application to users are determined by the permissions granted to the user's class by the System Administrator. The System Administrator assigns the user class to users. The default operations groups provided to each user class are defined below and may be modified by the System Administrator.

2.1.2.1 System Administrator Operations

The System Administrator shall have access to the operations provided by the application package. Provided operation groups include:

- User Registration
- User Login
- User Activity Selection
- User Profile Maintenance
- System Administration
- Database Management
- Initiate Web Crawler

2.2 Product Functions

The functions provided by the Semantic Web Crawler program are:

- HTTP/HTTPS crawler.
- I/O Operations.
- Content Storage.
- HTML & Data Parser.
- Database Management.
- User Interface.

2.2.1 HTTP/HTTPS Crawler

The Crawler Module is to provide the user the capability to crawl the Internet for information specified by the user. All possible forms of collected data shall be placed into a hash and sent to the third part of the Core for database integration and/or implementation. A Cloud managed MySQL Database through the Relational Database Service (RDS) Amazon services shall be utilized to design and store the database.

2.2.1.1 Processing

The user calls on the Crawler class through the User Activity Selection Menu GUI. Through data entry, the user can set the crawl parameters for the Internet crawl. When the Internet crawl is done with its crawl, it presents the user with any matches found. The Initiate Web Crawler shall

be called with the COTS Database Application and is presented to the user for user. During or upon completion of the activity, the user can store the current task in the personal computer (PC) memory.

2.2.2 I/O Operations

The IO Module has a very simple job; it helps translate data and formatting from the GUI and/or command line through to the application. The arguments that are given in the command line to the SWC compiled program are sorted and figured out at this level and shall be vital in allowing the crawler not just to input and understand how the data shall be crawled and parsed, but also the arguments shall help the application output the data whether in Structured Query Language (SQL) form to a database or in text form to a Comma Separated Values (CSV) file.

2.2.2.1 Processing

When the GUI or command line arguments are entered into the application, the IO class shall first parse and sort the incoming data, it shall figure out where all the moving parts shall fit into and then shall start the process of giving those command arguments over to the necessary classes so that the application can begin to work properly. Any arguments relating to the output shall be saved for last and shall come online as soon as the crawl is complete and the application is ready to release its data.

2.2.3 Content Storage

The Content Storage class is vital to keeping a low key and making sure that we are using the most critical of resources to the best possible capacity. In essence when a site is crawled, the data pulled from that page shall be saved to cache memory, that cache can be either stored locally or in an S3 bucket and is intended to allow the quick and immediate pulling of data from a page without the need to reach out into the Internet and download it again.

2.2.3.1 Processing

When a website is requested to download, the application shall first look in the cache folder, it shall search for the cached file that best fits the hash given from the address. If a date or time parameter has been given then the application shall search at the bottom of the page for the data that file was last cached, if the date does not fall within the necessary parameter then it shall re-download the site saving over that cached file in the process. Once it has determined that the date meets the necessary parameters then the system shall load the files as needed into the parser.

2.2.4 HTML & Data Parser

The Parser class has one of the hardest jobs of the whole crawler; in essence it has to take the data that's been pulled in and figure out what it means and how to parse it. It is vital that the parser functions at a very fast speed as this process takes about 90% of the overall SWC run time. If this system runs slow then the Semantic Web Crawler as a whole shall be classified as slow and our mission to do what scripting languages do but at a compiled level shall have failed.

2.2.4.1 Processing

When both the IO, Content Storage and Crawler classes are done doing their jobs, all of the information pulled is loaded into the Parser. By using the arguments provided by the IO class, the parser shall then quickly run through the data looking for all of the relevant information ensuring that it's pulling the relevant information as it needs to into a hash to be dumped into a flat file or database later.

2.2.5 Database Management

All possible forms of collected data shall be placed into a hash and sent to the third part of the Core for database integration and/or implementation. A Cloud managed MySQL Database through the RDS Amazon services shall be utilized to design and store the database. Due to the modularity of the system, this is a benefit to the client as the client may choose to port the entire system to a local system if they no longer continue to utilize Amazon Web Service (AWS).

2.2.5.1 Processing

The SWC program requests the deployment of the database application on the host computer to enable the designated users the capability to manipulate the database. When the database management functions are complete the COTS database application returns control to the SWC program.

2.2.6 User Interface

2.2.6.1 User Registration

The User Registration Module provides access to create a user profile for the SWC program. It ensures that the user creates a User Name, a password to provide access, and to provide an E-mail address for updates and information from the System Administrator.

2.2.6.1.1 Processing

The User Registration Module receives the User Name, E-mail address, and password entered by the user and queries the database to determine if the User Name is in use and if it is not in use,

the User Registration Module creates the new user profile. If the User Name is in user, the User Registration Module notifies the user that the User Name is in use and must re-enter another User Name.

2.2.6.2 User Login

The User Login Module provides access to the Semantic Web Crawler program for authorized users. It ensures that only authorized users are provided access and notifies the GUI manager as to the GUI's and permissions the user is authorized in the database.

2.2.6.2.1 Processing

The User Login Module receives the User Name and Password entered by the user and queries the database to determine the validity of the User Name and, if valid, the associated password. The number of opportunities to attempt login can be limited.

2.2.6.3 User Activity Selection

The User Selection Menu GUI provides the user with the capability to select the activity they want to perform. The User Activity Selection Menu GUI provides access to the SWC program by providing GUI's to the user.

2.2.6.3.1 Processing

The User Activity Selection Module accepts the request to launch the GUI set chosen by the user as defined by the User Name. The module requests the GUI profile of the logged in user with the User Name and receives the profile in return.

2.2.6.4 User Profile Maintenance

The User Profile Maintenance Module allows an authorized system user to change selected items in their profile to keep it current. These items include the users Email address and password.

2.2.6.4.1 Processing

The user calls on the User Profile Maintenance Module with the User Name. The module returns the fields in the database that the user is authorized to modify and displays the current data on the GUI. The user then edits the data and submits the changes to the module to update the database.

2.2.6.5 System Administration

The System Administration Module provides the user access to the User Profile functions of the Semantic Web Crawler program.

2.2.6.5.1 Create User Profile

The Create User Profile Module allows the user to add a new user profile within the Semantic Web Crawler System Security Module. The profile contains identifying factors of the user that can be used for identification. The user profile is stored in the database and accessed as part of the user authorization process to validate the user's access to the system and define the authorized permissions.

2.2.6.5.1.1 Processing

The user calls on the Create User Profile Module to display the appropriate GUI. The user then inputs data to the appropriate data fields of the Create User Profile GUI and executes the function. The application sends the new user profile information to the database for error checking and the registration of the new user in the database. The database error checks the data and provides either a positive acknowledgement that the new user has been created or an error message defining which data is incorrect. The User Name is the only field that must be unique in the database and duplication of any other fields is permitted.

2.2.6.5.2 Modify or Delete User Profile

The Modify or Delete User Profile allows the user to modify or delete user profiles within the SWC program. Identifying factors of the user that can be used to identify them and contact information are contained in the user's profile. The user's profile is stored in the database and can be accessed as part of the user authorization process to validate the user's access to the system and define the authorized permissions. The user modifies or deletes a user profile through the use of a GUI interface.

2.2.6.5.2.1 Processing

The user calls on the Modify or Delete User Profile Module with the User Name of the profile to be modified. The database returns the existing user profile and displays the current data of the user profile on the GUI. The user either deletes the profile by executing the delete action or modifies the selected parameters by editing the existing data and executing the modify action. Executing the modify action results in the new information being forwarded to the database function for error checking and the registration of the new information in the database. The database error checks the data and either returns a positive acknowledgement that the user data has been updated or an error message defining which data is incorrect. The User Name is the only field that cannot be modified and is mandatory and duplication of any data in the other fields is permitted.

2.3 Non-Functional Requirements

2.3.1 Efficiency

The SWC program is designed to run primarily in the background. The user shall associate parameters based on need and the program shall capture requirements and deposit results into cache on the local machine or cloud based storage that is retrieved as necessary.

2.3.2 Reliability

Specific reliability requirements are as follows:

- System availability of 99.9%
- System re-crawl to initial conditions in less than 10 seconds.
- System re-crawl to program saved on external memory in less than 10 seconds
- Security against unauthorized user access of 99.9%
- SWC program availability of 99.9%
- SWC program re-crawl to initial conditions from failure in less than 10 seconds.
- SWC program re-crawl to program saved on external memory in less than 10 seconds.

2.3.3 Usability

The key factor for maximizing usability is to employ the iterative design, which progressively refines the design through evaluation from the early stages of design. The successive evaluation steps shall enable the software designers and software developers to incorporate user and client feedback until the system reaches an acceptable level of usability.

2.3.4 Correctness

The SWC software must operate correctly in order to provide the desired level of value to the customer. Correctness shall be evaluated by determining the defects per thousand lines of code (KLOC) reported by the user of the program following software release for general use. The target for the SWC program is < 1%. To ensure meeting this goal the product shall meet a correctness of <0.1% during testing prior to release for general use.

2.3.5 Maintainability

The SWC program code base is highly modular in design, allowing for maximum code reuse and easy maintenance. Data access and common operations are encapsulated in classes that de-couple the interface.

2.3.6 Portability

The SWC program is being developed within an object-oriented architecture that encapsulates the data and operations. This shall allow the usability of the software in different environments.

Utilizing portability shall be determined by the use of abstraction between the application logic and the system interfaces.

2.3.7 Testability

In order to determine a consistent and complete software product, an in-depth testing program shall be utilized to demonstrate software fulfillment of each of the requirements. A key factor in testing is the user friendliness of the SWC program. An unambiguous approach shall be utilized to gain a quantitative evaluation of the SWC.

2.3.8 Modifiability

Modification of the SWC project shall correct faults and improve performance along multiple platforms. The modified software shall align with the customer priorities and staffing, allowing the modifications. The areas of importance are as follows:

- Adaptive – dealing with changes and adapting in the software environment
- Perfective – accommodating with new or changed user requirements which concern functional enhancements to the software
- Corrective – dealing with errors found and solutions

2.3.9 Availability

Availability is the proportion of time a system is in a functioning condition. MTBF (Mean time between failure) and MTTR (Mean time to repair) values are estimated for each component of the software system. This shall be based upon a system availability of 99.9% and a SWC program availability of 99.9%.

2.3.10 Performance

Performance modeling shall be performed utilizing the use case information as the input. For the SWC software system, a performance monitoring plan shall be developed. Performance software engineering applies a subset of activities related to performance monitoring, both for the performance test environment as well as for the production environment.

2.3.11 Security

The Semantic Web Crawler program control shall utilize a User Login and password. This shall be associated with a user Email to assure uniqueness.

2.4 User Characteristics

The users of the Semantic Web Crawler program shall be end users utilizing the implemented criteria entered into the parameter searches. User privileges are controlled through the user login routine. Data entry, other than User Name and password shall be accomplished with menus and displays.

2.5 Constraints

This section lists constraints that have an influence on development of the Semantic Web Crawler program and discusses the effects resulting from failure to comply with those constraints.

2.5.1 Computer Requirements

Host computer requirements for the Semantic Web Crawler program are determined by the application modules to be implemented. Applications over the Internet have a significant impact on processing and memory functions. When using the application, a reliable connection is required. An unreliable connection could cause unpredictable operation of the system, including loss or corruption of data.

2.5.1.1 Hardware Requirements

Host computer hardware requirements must provide the basic capabilities and features to support the installed OS, the Semantic Web Crawler software, and the external interfaces that are consistent with the OS. The minimum computer requirements and features are:

- 1 Gigahertz (GHz) processor, Pentium or equivalent.
- Linux Operating System
- 2 GB of RAM
- 5 GB of hard-disk space for storage
- Monitor
- Keyboard
- Pointing device

2.5.1.2 Internet Requirements

Access to the SWC program requires a full-time Internet connection (i.e. Digital Subscriber Line (DSL) or Cable service), to provide a gateway between the home and the Internet. To accomplish this, any one of the following connection configurations is required:

- Static Internet Protocol (IP) Address. A static IP address is a dedicated IP address assigned to the Internet account by the Internet Service Provider (ISP).
- Dynamic Domain Name Service (DNS) Service - Dynamic DNS is a service that allows the user to alias the assigned Dynamic IP address to a permanent hostname, allowing the computer to be more easily accessed from various locations on the Internet. This allows the user to access the SWC program via the web server over the Internet by entering the static host name instead of the currently assigned Dynamic IP address.

2.6 Assumptions and Dependencies

The assumptions and dependency requirements in this document are subject to:

- The host computer meets the minimum hardware and software requirements outlined in section 2.5.1.1 and 2.5.1.2 of this document
- The host computer is able to maintain a reliable Transmission Control Protocol (TCP)/IP connection as outlined in section 2.5.1.2 of this document
- The system administrators have the necessary familiarity with the selected database and GUI development tools as outlined in section 2.2.5 and 2.2.6 of this document

2.7 Apportionment of Requirements

This subsection identifies the requirements that shall be delayed until future versions of the system. Future enhancements to the software and database storage and retrieval may lead to a resident application of the data in a local capacity.

3.0 Specific Requirements

3.1 System Interfaces

3.1.1 User Interfaces

The GUI is the primary interface between the SWC program and the user, the user can be, but not limited to, a System Administrator, client, or guest user. The GUI provides the means for accessing the modules for use, finishing the desired activities, saving the results, and exiting the application.

3.1.1.1 Graphical User Interface

The GUI interface between the SWC program and the user shall be designed to be as user-friendly as possible. The user can be, but not limited to, a System Administrator, client, or guest user. See sections 3.4.1.2, 3.4.2.2, 3.4.3.2, 3.4.4.2, 3.4.5.2, and 3.4.7.2 for the GUI drawings. The following goals shall be met:

- The user interface shall emulate a simple and easy to use layout.
- The user interface shall be compatible with all common and current Internet Explorers, such as Microsoft Internet Explorer and Mozilla Firefox, in order to provide this capability to the user.
- Regardless of the user's platform, the user interface shall look and behave the same. At a minimum, the user interface shall properly display on the current Windows operating system.
- With the exception of generated reports, all the screens shall show all controls and information when maximized on any resolution setting due to the use of percentages for screen sizing and not pixel settings. Reports shall show all columns and rows of information within the chosen size on any resolution setting for the display.
- In each screen there shall be a link to a specific help topic explaining the purpose of every control on the screen.

- In each screen there shall be a link to allow the user to E-mail the System Administrator and/or provide the System Administrator's contact phone number. If the user has any difficulties with the system, they shall be able to contact the System Administrator to resolve the issue.

3.1.2 Software Interfaces

The SWC Software Interfaces are of two types:

- Underlying Operating System.
- Internet applications.

3.1.2.1 Underlying Operating System Interface

Like all software applications, the SWC software interfaces with the underlying operating system. The SWC software depends on the operating system to provide a dependable platform for executing the applications and web browser access. The operating system is responsible for implementing the SWC software with the Internet applications. The minimum acceptable host platform operating systems are defined in Section 2.5.1 of the SRS.

3.1.2.2 Internet Applications Interface

3.1.2.2.1 Database Application Interface

The SWC program shall employ a database application that resides on the host PC to meet all consistent data storage requirements. The database is intended to store the following:

- Logs and records of specific searches.
- Security Data for determining authorized users and allowing access to the stored information based on individually assigned passwords.

In addition to storage, the database application shall process queries, search for data based on queries, provide reports to the requester in either preformatted forms or uniquely designed forms, and error check user updates to the data.

3.2 Memory Constraints

3.2.1 Host Computer Constraints

The SWC program is designed to operate on a committed computer running the selected OS. The computer requirements are listed in Section 2.5.1 of the SRS.

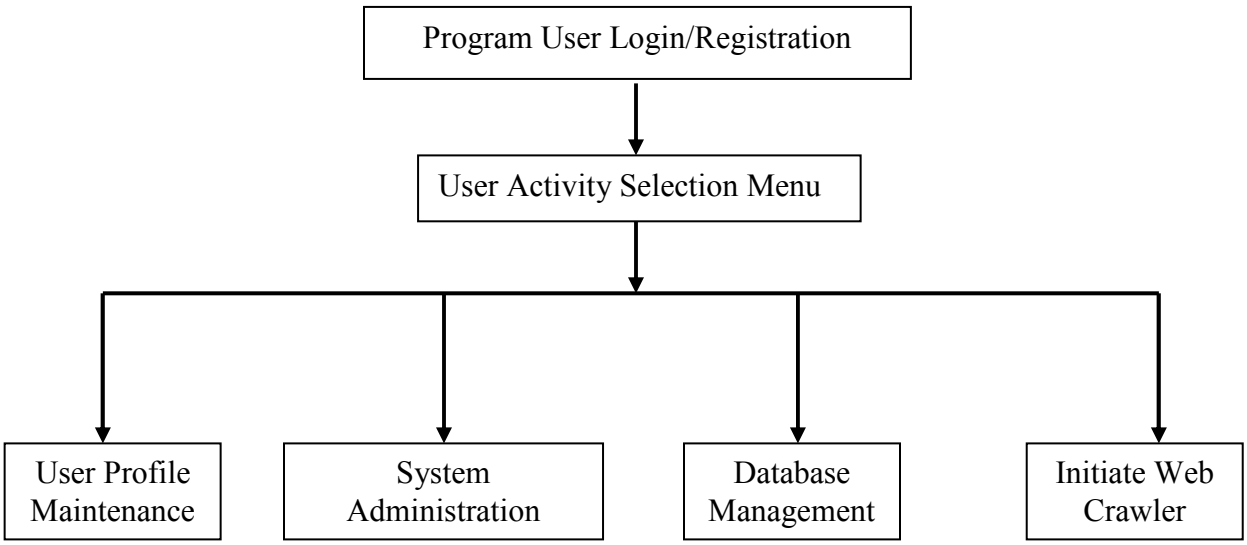
3.3 Website Adaptation Requirements

Each website shall implement the SWC software on a suitable host computer with a compatible OS and capabilities as addressed in Section 2.5.1 of the SRS. No specific adaptation requirements are foreseen as each website shall be implemented as a complete unit.

3.4 Use Case Analysis

This section provides an overview of the functionality that shall be provided by the SWC program. The section is organized into *Use Cases,* where a scenario of the user activities represents a task or set of tasks that shall be executed by the users of the system on a regular basis. All the user functions are executed through GUIs that are managed by the GUI manager. The Use Cases shall be discussed in the context of the GUI management. The GUI manager is based on the function distribution displayed in Figure 3.1.

FIGURE 3.1 GUI MANAGER FUNCTION DISTRIBUTION



3.4.1 User Registration

3.4.1.1 Purpose

The purpose of the User Registration is to create a user profile for the SWC program. It ensures that the user creates a User Name, a password to provide access, and to provide an E-mail address for updates and information from the System Administrator.

3.4.1.2 Functionality

Initiating the SWC program on the desktop accesses the User Registration Module. The module shall create a class and permissions of the user during the registration process. See Figures 3.2, 3.3, and 3.4.

FIGURE 3.2 USE CASE FOR REGISTRATION

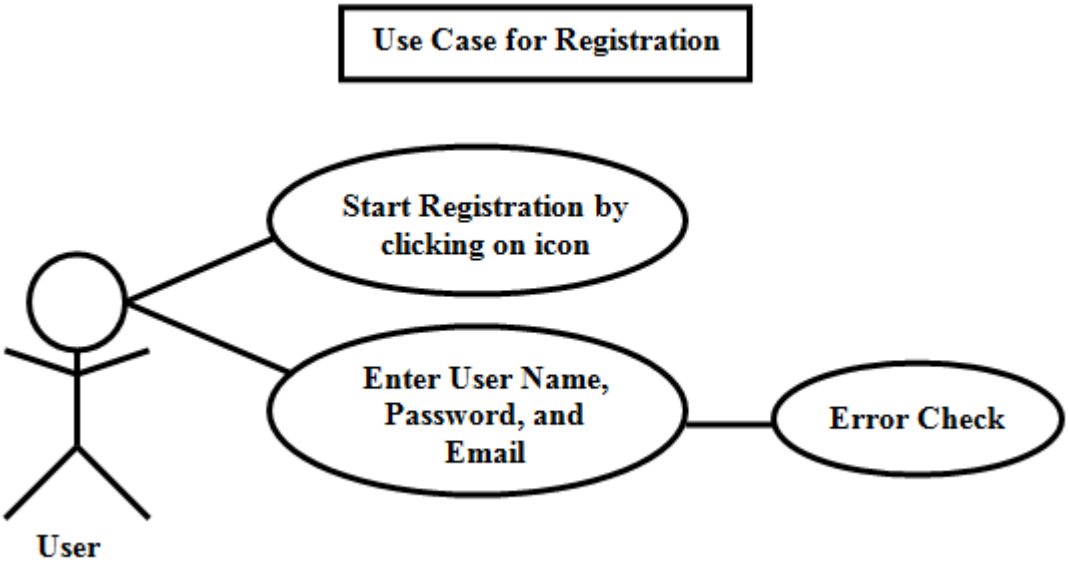


FIGURE 3.3 REGISTRATION GUI

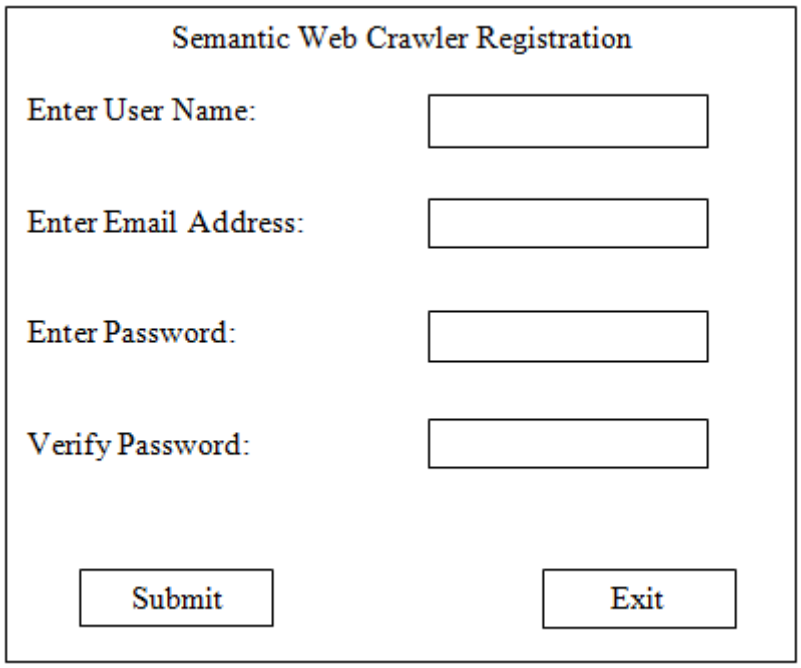
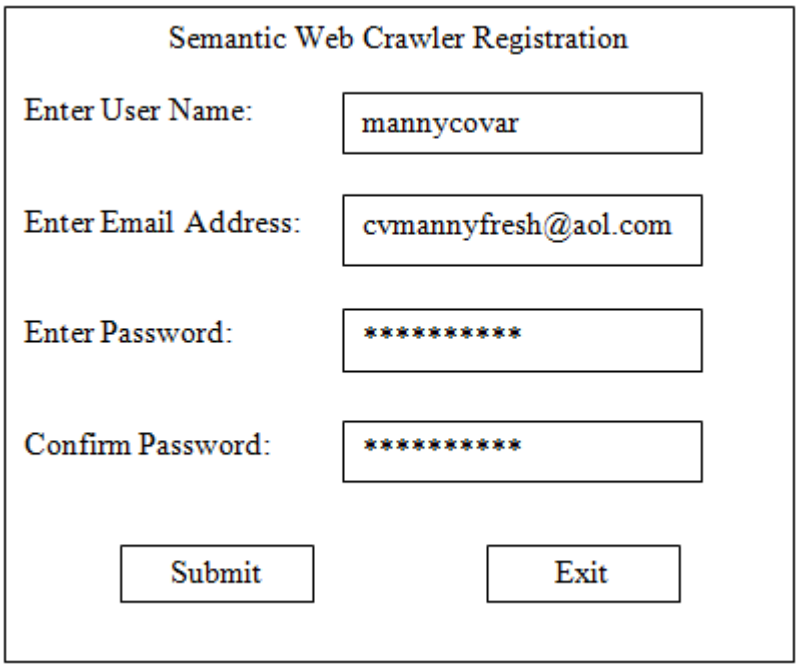


FIGURE 3.4 REGISTRATION GUI WITH USER INFORMATION



3.4.1.3 Stimulus-Response Sequence

- The user initiates operation of the SWC program either from the programs menu or a desktop icon.
- The application response by opening the home web page. The application notifies the user that they can either login or register to access the SWC program. Since this is the users first time accessing the SWC program, they have to register. When the user selects to register, the SWC program opens a window so the user can input their User Name, password, and E-mail address.
- The user enters the registration data through data entry and submits it to the security program with either the *Submit* button or the *Enter* key. The function is cancelled with the *Exit* button.
- Upon submission, the application shall check to see if the User Name is already in use by another user. If not, it shall accept the new User Name, password, and E-mail address. Once the registration is complete, the server returns the User Activity Selection page for the user to begin using.

3.4.1.4 Use Case Diagram

Activity	Agent	Stimulus	Response
1	User	Calls the SWC Program.	
2	SWC Program		Presents the user with the choice to login or register.
3	User	Chooses to register.	
4	SWC Program		Presents user with Registration GUI.
5	User	Enters information.	
6	SWC Program		Checks to see if the user name is already in use. If not, creates a new user profile.
7	User	Chooses to exit.	
8	SWC Program		Exits Registration GUI.

3.4.2 User Login

3.4.2.1 Purpose

The purpose of the User Login GUI is to control access to the SWC program. It ensures that only authorized users are provided access and notifies the GUI manager as to the permissions the user is authorized in the database.

3.4.2.2 Functionality

Initiating the SWC program on the desktop computer accesses the User Login Module. Based on the user login, the module shall determine the permissions of the user. As a result the Activity Selection Menu GUI with the available activity options is presented by the GUI manager. Functionalities to be available for authorized user are described in Section 2.1.2. See Figures 3.5, 3.6, and 3.7.

FIGURE 3.5 USE CASE FOR LOGIN

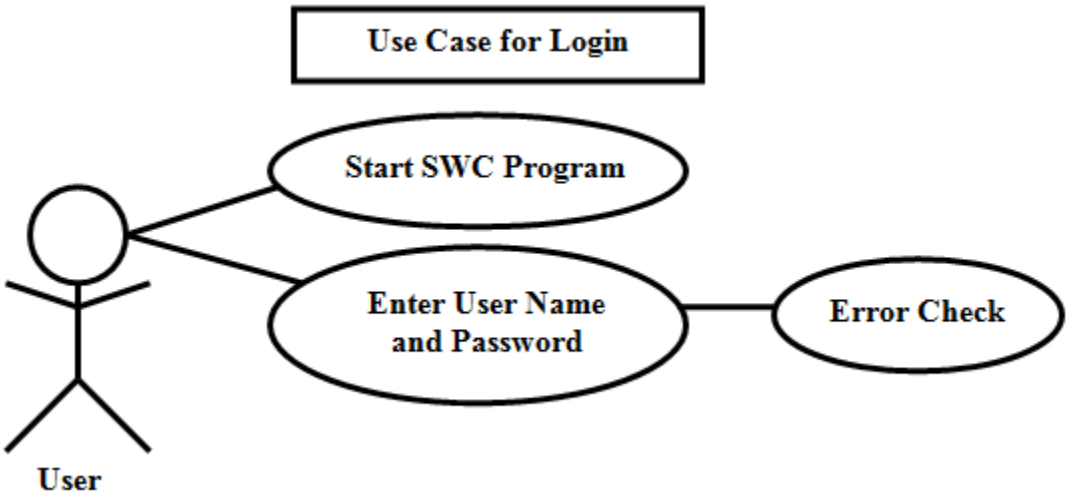


FIGURE 3.6 LOGIN GUI

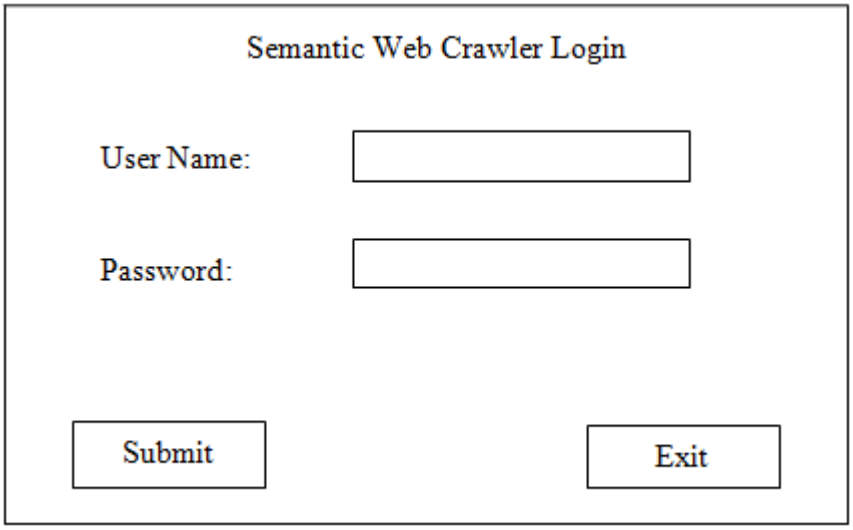
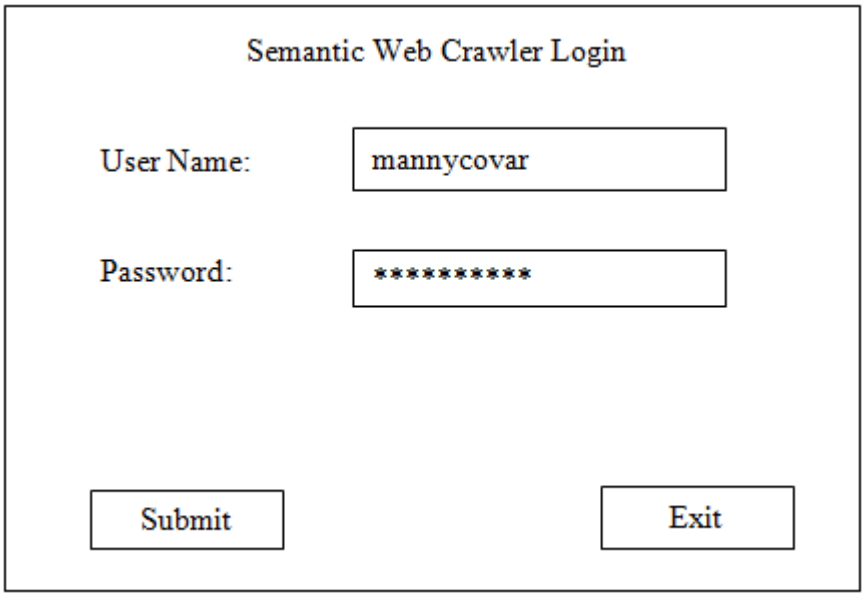


FIGURE 3.7 LOGIN GUI WITH USER INFORMATION



3.4.2.3 Stimulus-Response Sequence

- The user initiates operation of the SWC program either from the programs menu or a desktop icon.
- The application responds by returning the login page that requests the user to enter their User Name and password. Blank data entry windows for the User Name and Password, with the cursor in the first space of the User Name window, are presented to the user. The window fields have the appropriate labels next to them to indicate the intended content.
- The user enters the login data and submits it to the security program the *Submit* button. The function is cancelled with the *Exit* button.
- Upon submission, the server validates the User Name against the list of authorized users and if the User Name is valid it checks the password against the security data for that user. If both are valid it checks the password update parameters to determine when the password shall be changed.
- If the data is correct, the server returns the User Activity Selection page for the user that has successfully logged in with a greeting to the user with their proper name and a welcome page inviting them to proceed with selection of an application from a menu of applications.
- If the data is not correct, the server shall request the user to re-enter the data. If a successful login is not accomplished, the user is locked out and must contact the System Administrator for access.

3.4.2.4 Use Case Diagram

Activity	Agent	Stimulus	Response
1	User	Call SWC Program.	
2	SWC Program		Presents the SWC Login Page GUI that requests entry of the User Name and Password or Exit.
3	User	Enters Login User Name and Password and submits with the GUI Login *Submit* button or selects the *Exit* button to exit the application.	
4	SWC Program		If the user selects Exit, they are returned on the previously existing status of the OS. If Login is executed and the data is valid, the server presents the activity selection page to the user. If Login is executed and the data is not valid the server requests the user to re-enter the data again. If the user is unable to successfully enter the login data, they are locked out and entry can only be achieved through intervention of the System Administrator. The workstation is returned to the previous status.
5	User	The user selects the desired activity from the menu either with the pointer or by submitting the request with the *Submit* button or selects the *Exit* button.	
6	SWC Program		The module returns the chosen option from the Activity Selection GUI.

3.4.3 User Activity Selection

3.4.3.1 Purpose

The User Activity Selection Menu GUI's purpose is to provide the user with the ability to select which activity they desire to perform.

3.4.3.2 Functionality

To access the User Activity Selection Menu GUI, the user must successfully login to the SWC program. The GUI manager accepts the User Name from the Login function and returns the User Activity Selection Menu GUI. The User Activity Selection Menu GUI presented to the user shall be one of the following classes based on their permissions in the security module.

- System Administrator
- User

Based on the user permissions recorded in the security module and broadly defined in Section 2.1.2, the User Activity Selection Menu GUI displays a selection of the following activities. The available activities shall include the following:

- User Registration
- User Login
- User Activity Selection
- User Profile Maintenance
- System Administration
- Database Management
- Initiate Web Crawler

See Figures 3.8 and 3.9.

FIGURE 3.8 USE CASE FOR USER ACTIVITY SELECTION

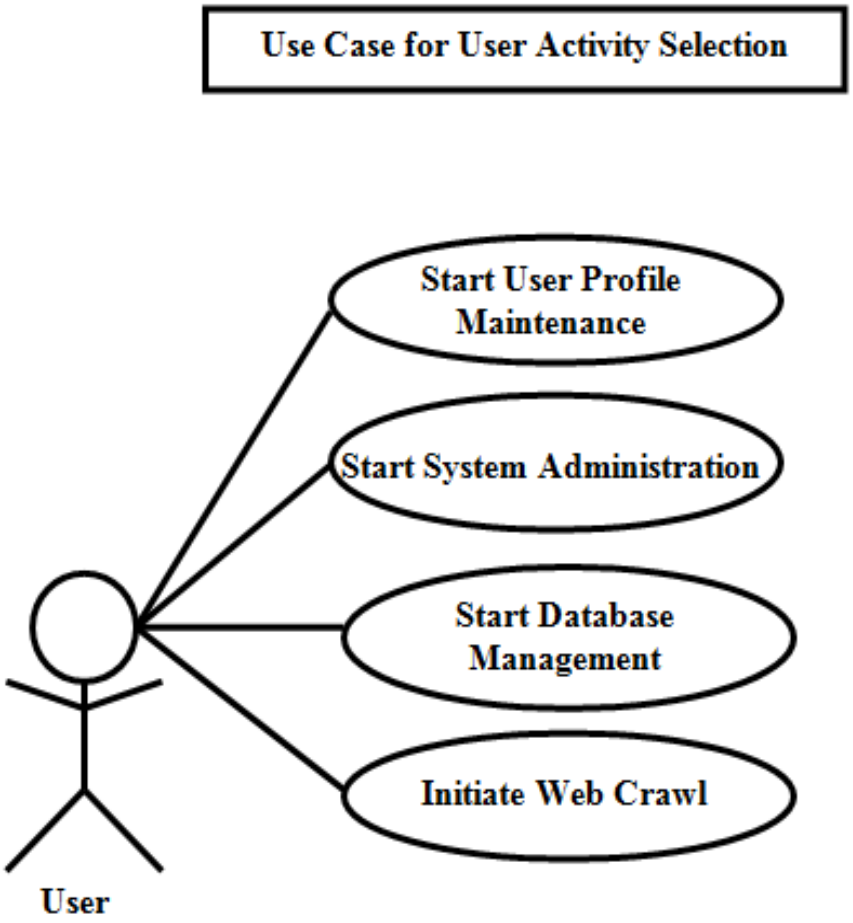
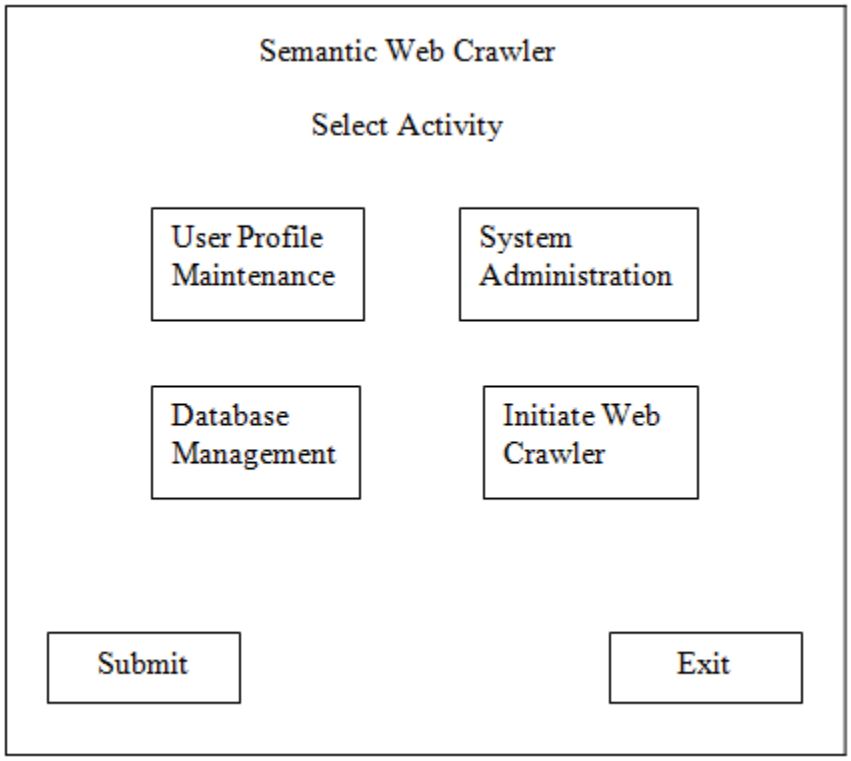


FIGURE 3.9 USER ACTIVITY SELECTION MENU GUI



3.4.3.3 Stimulus-Response Sequence

- In response to a successful login, the user is presented with the User Activity Selection Menu GUI.
- The user chooses the desired activity from the GUI either with the pointer or by tabbing up and/or down. The user starts the activity either with the *Submit* button or the *Enter* key.
- The application responds by returning the selected modules entry page to the user.
- The user navigates through the chosen module GUI to perform the desired activities with the application. When the activity is complete, the user selects the *Exit* button.
- Choosing exit on the modules GUI shall cause the application to close and return the user to the previous status of the OS.

3.4.3.4 Use Case Diagram

Activity	Agent	Stimulus	Response
1	SWC Program		Successful login prompts the application to present the User Activity Selection Menu GUI to the user.
2	User	The User selects either the *Exit* button or the desired activity from the menu with either the pointer or by tabbing up and/or down and then pressing either the GUI *Enter* button or the *Enter* key.	
3	SWC Program		If an activity is selected, the requested modules entry page is presented to the user for use. If the *Exit* button has been selected, the user is returned to the previous status of the OS.
4	User	Using the modules GUI, the user navigates through them to accomplish the desired activity and when done, exits the application.	
5	SWC Program		The application closes and returns the user to the previous status of the OS, when a request to exit the application is made.

3.4.4 User Profile Maintenance

3.4.4.1 Purpose

The purpose of the User Profile Maintenance Module is to allow the user to update their user profile.

3.4.4.2 Functionality

By navigating through the SWC User Activity Selection Menu GUI, the User Profile Maintenance GUI is accessed. When selected it displays the data currently in the database that the user has authorization to update and allows the data to be updated. The contents of the fields are modified by selecting the field with the pointer or by tabbing up and/or down and using the standard keyboards functions to edit the contents within the field. All of the following data options may be updated by the user:

- E-mail Address
- Password
- Website Preferences

When the data has been changed on the User Profile Maintenance GUI, the user submits the changes with the *Submit* button or the *Enter* key. When the data has been successfully updated in the database, the module shall give a message indicating success. If any errors are found during the error checking, the field with the error shall be highlighted and the user is requested to re-modify the data. When the change operations are complete, the user returns to the User Activity Selection Menu GUI by selecting the *Exit* button. See Figures 3.10 and 3.11.

FIGURE 3.10 USE CASE FOR USER PROFILE MAINTENANCE

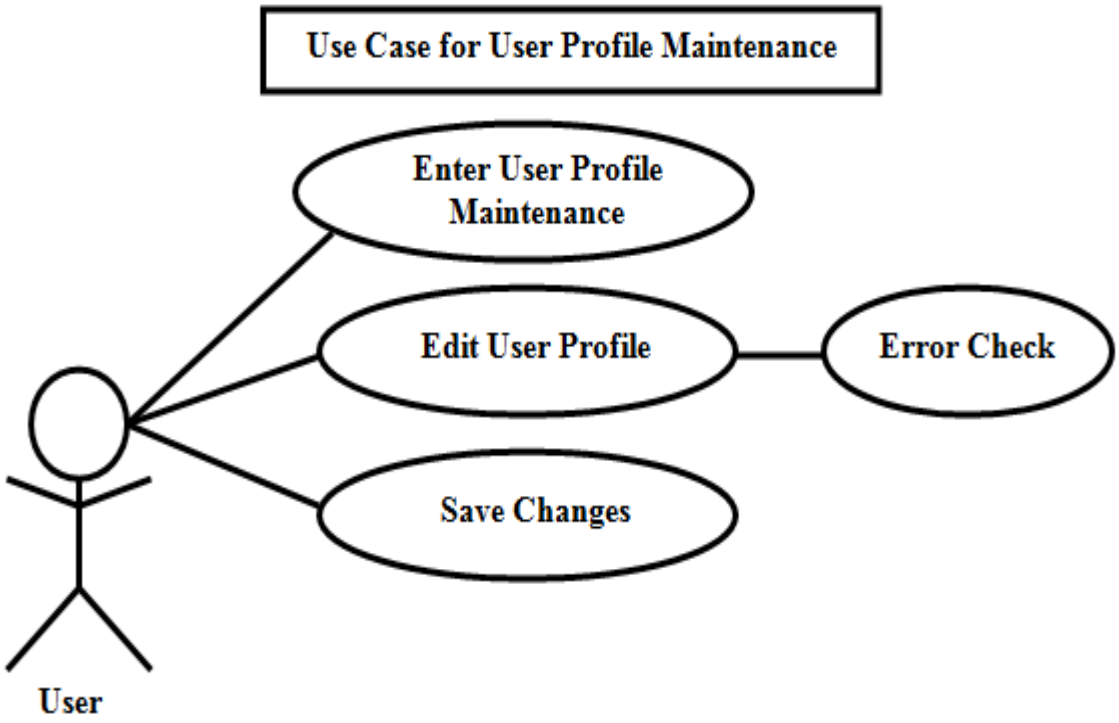
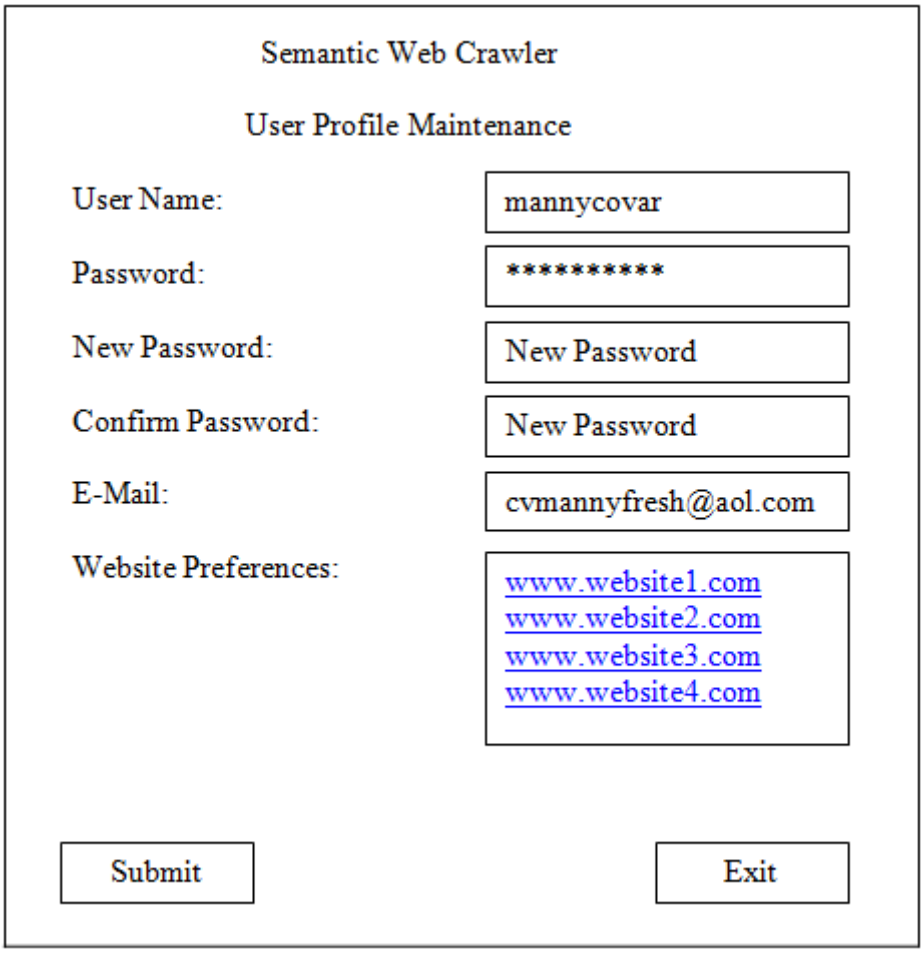


FIGURE 3.11 USER PROFILE MAINTENANCE GUI



3.4.4.3 Stimulus-Response Sequence

- The User Profile Maintenance GUI with the fields the user is authorized to update and the data currently recorded in the database is displayed in response to the user's selection of the User Profile Maintenance on the User Activity Selection Menu GUI. The fields shall be identified with a title indicating the data that is contained.
- The user shall identify the field to be updated either with the pointer or by tabbing up and/or down.
- The user shall edit data using the normal combination of the keyboard and pointer utilities.
- When done with the editing, the user can submit the new data either by pointing to the *Submit* button or pressing the *Enter* key.
- The system shall respond to the submission request with a verification request. The verification options are:

    - Yes
    - No, Continue Editing

    The option selection is done either with the pointer or by tabbing up and/or down. The user can confirm the selection either with the *Submit* button or the *Enter* key.

    - If *Yes* is selected, the database is updated.
    - If *No, Continue Editing* is selected, no changes take place and the user may continue editing.

- The *Exit* button is used to return to the User Activity Selection Menu GUI.

3.4.4.4 Use Case Diagram

3.4.4.4 Use Case Diagram			
Activity	**Agent**	**Stimulus**	**Response**
1	SWC Program		In response to the user request to update their user profile information, the module presents the User Profile Maintenance GUI with the user data currently in the database that the user is authorized to update.
2	User	The user selects the data fields to update with the pointer or by tabbing up and/or down and updates the data with the normal keyboard functions. When data update is complete the user submits the data with the *Submit* button or the *Enter* key.	
3	SWC Program		The module error checks the new data and queries the user to verify updates with options.
4	User	If required, the user corrects any incorrect data and selects either the *Submit* button or the *Enter* key with the pointer or by tabbing up and/or down to update the data.	
5	SWC Program		The module error checks the corrected data and queries the user to verify the updates and offers options. Or if no errors require any correction, the requested action is accomplished and the user is notified.

3.4.4.4 Use Case Diagram			
Activity	**Agent**	**Stimulus**	**Response**
6	User	Exits the module by selecting the *Exit* button with the pointer or tabbing up and/or down to it and using the *Enter* Key	
7	SWC Program		Returns the user to the User Activity Selection Menu GUI.

3.4.5 System Administration

3.4.5.1 Functionality

The purpose of the System Administration Module is to provide the user the capability to manage their user profile by creating a new user profile and by editing or deleting exiting files.

3.4.5.2 Functionality

The System Administration GUI is accessed by navigation through the SWC User Activity Selection Menu GUI. The System Administration GUI provides the user a menu with the options:

- Create New User Profile
- Modify or Delete User Profile
- Exit

The user selects the System Administration Activity to be performed with the pointer and either presses the *Submit* button or the *Enter* key. Selecting the *Exit* button returns the user to the User Activity Selection Menu GUI.

The Create New User Profile GUI displays a blank user profile GUI. The user fills in the fields with data entry. When the data entry is complete, the user submits the data to the database with the *Submit* button. The module error checks the entered data and either updates the database or returns an error message. The erroneous data is highlighted. The *Exit* button returns the user to the System Administration Activity Selection GUI.

The Modify or Delete User Profile Activity requests the user to enter in the User Name of the profile to be modified or deleted. The selected profile with the data currently in the database is displayed when the User Name is submitted. The user can either modify the data and submit it with the *Submit* button or delete the profile with the *Delete* button. Prior to implementation, the module confirms the selected action. The module responds with a confirmation that the selected activity was completed. The module then queries the user if they would like to modify or delete an additional profile. Selecting the *No* button returns the user to the System Administration Activity Selection GUI. Selecting the *Yes* button allows the user to access another profile. See Figures 3.12, 3.13, 3.14, and 3.15.

FIGURE 3.12 USE CASE FOR SYSTEM ADMINISTRATION

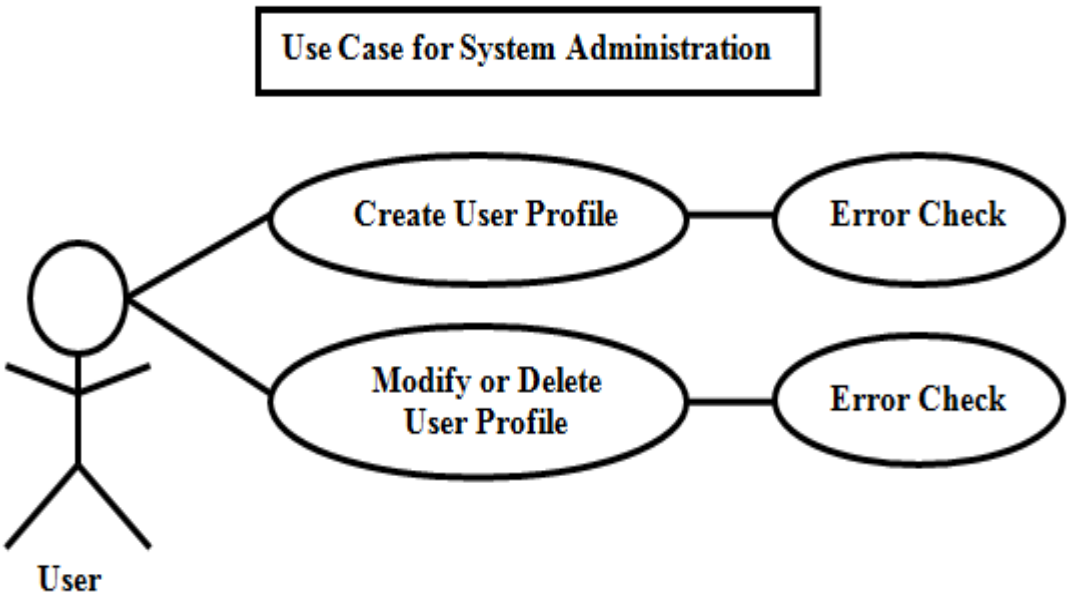


FIGURE 3.13 SYSTEM ADMINISTRATION MENU GUI

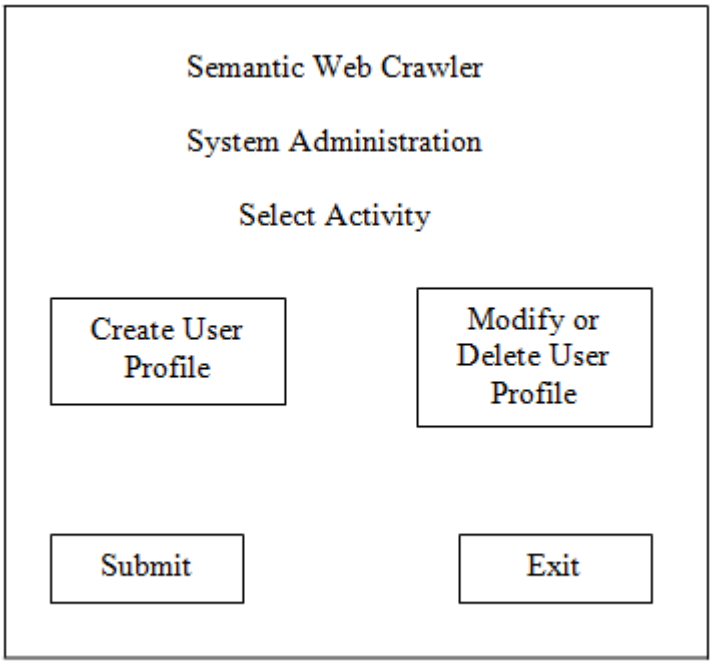


FIGURE 3.14 CREATE NEW USER PROFILE GUI

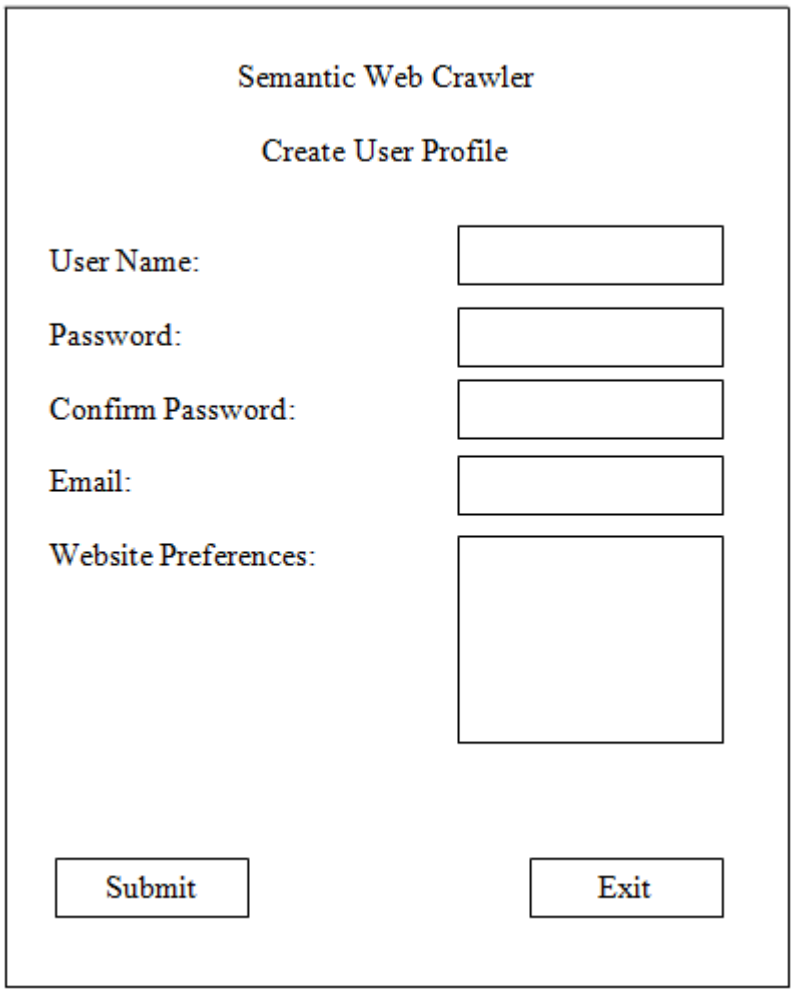
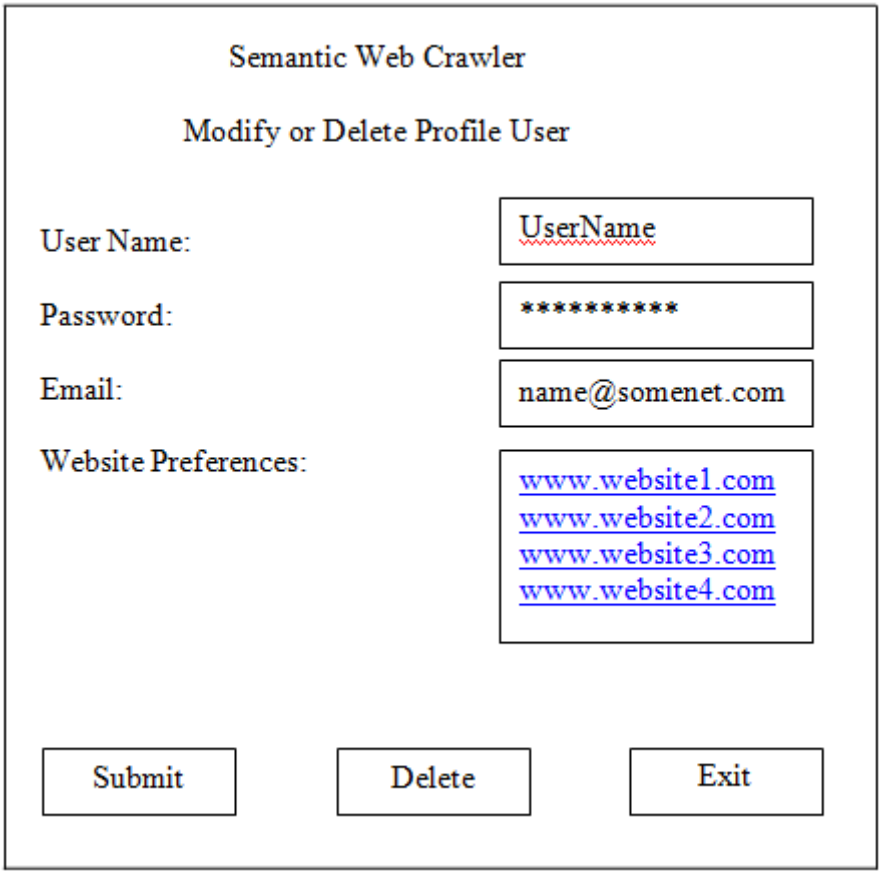


FIGURE 3.15 MODIFY OR DELETE USER PROFILE GUI



3.4.5.3 Stimulus-Response Sequence

- The user selects the System Administration Module from the User Activity Menu GUI.
- The module responds by returning the System Administration Activity Selection GUI. The GUI provides the options:
    - Create New User Profile
    - Modify or Delete User Profile
    - Exit
- The user selects one of these three options.
- Selecting the *Exit* button returns the user to the User Activity Selection Menu GUI.
- The Create New User Profile option returns a blank user profile GUI to be filled with data through data entry.
- The Modify or Delete User Profile GUI requires the user to enter the User Name to be modified or deleted and submits the request to the application with the *Submit* button.
- The module returns a GUI with the data for the User Name entered. The GUI contains the data currently in the database.
- If the user chooses to delete the user profile, they press the *Delete* button with the pointing device.

- The module queries the user if they really want to delete the profile.
- The user either confirms the deletion by pressing the *Delete* button again or presses the *Exit* button to exit.
- If the user chooses to modify the profile, they modify the contents of the desired fields and submit the changes to the database with the *Submit* button.
- The module error checks the modified fields and either sends the changes to the database and returns a confirmation message of the database update to the user or returns an error message with the fields in error highlighted.
- If the user receives an error message, the user either corrects the data or exits the GUI with the *Exit* button without modifying the database.
- When the user completes all of the desired activities, the user exits the GUI with the *Exit* button which returns the user to the System Administration Activity Selection GUI.

3.4.5.4 Use Case Diagram

3.4.5.4 Use Case Diagram			
Activity	**Agent**	**Stimulus**	**Response**
1	SWC Program		In response to the user request to use the System Administration Module, the program returns the System Administration Menu GUI.
2	User	The user selects either Create User Profile or Modify or Delete User Profile with the pointing device and submits the request to module.	
3	SWC Program		If the user selects the Create User Profile, the module returns a blank Create User Profile GUI to be filled in by the user.
4	User	The user fills in the blank fields through data entry and submits the new user profile with either the *Submit* button or *Enter* key.	

3.4.5.4 Use Case Diagram			
Activity	**Agent**	**Stimulus**	**Response**
5	SWC Program		If the user selects the Modify or Delete User Profile, the module returns a User Name scroll window of all the current users for the user to select to be modified or deleted from.
6	User	The user chooses the User Name to be modified or deleted and submits it to the module with the *Submit* button or *Enter* key.	
7	SWC Program		The module returns the Modify or Delete User Profile GUI with all the user data currently in the database for the selected User Name.
8	User	The user makes the necessary changes on the GUI and submits the new changes with either the *Submit* button or *Enter* key. To delete the user profile, the user presses the *Delete* button. To cancel, the user presses the *Exit* button.	

3.4.5.4 Use Case Diagram			
Activity	**Agent**	**Stimulus**	**Response**
9	SWC Program		If the *Delete* button has been selected, the module directs the user to confirm intention to delete by selecting the *Delete* button a second time. If the Create or Modify actions are submitted, the module error checks the data and either returns an error message with the fields in error highlighted or directs the user to confirm intention to submit the data by selecting the *Submit* button a second time. When all data fields clear the error checking, the module submits the changes to the database and returns a confirmation message to the user to notify that the changes have been successfully accomplished.
10	User	The user exits the module by selecting the *Exit* button with the pointer or tabbing up and/or down to it and using the *Enter* key.	
11	SWC Program		The module returns the user to the User Activity Selection Menu GUI.

3.4.6 Database Management

3.4.6.1 Purpose

The Database Management Module's purpose is to allow the user to manipulate the database.

3.4.6.2 Functionality

The Database Management Module is accessed by navigation through the SWC User Activity Selection Menu GUI. The user selects it by pointing or tabbing up and/or down to the *Database*

Management button on the User Activity Selection Menu GUI and pressing either the *Submit* button or the *Enter* key on the keyboard. The SWC Database shall be called with the COTS Database Application and is presented to the user for use. All of the capabilities provided by the COTS Product shall be provided to the user. During or upon completion of the activity, the user can store the current task in the PC memory. When the work is complete, the user closes the application. The system shall prompt the user as to whether they want to save the current work or close the application without saving and execute the action selected. See Figure 3.16.

FIGURE 3.16 USE CASE FOR DATABASE MANAGEMENT

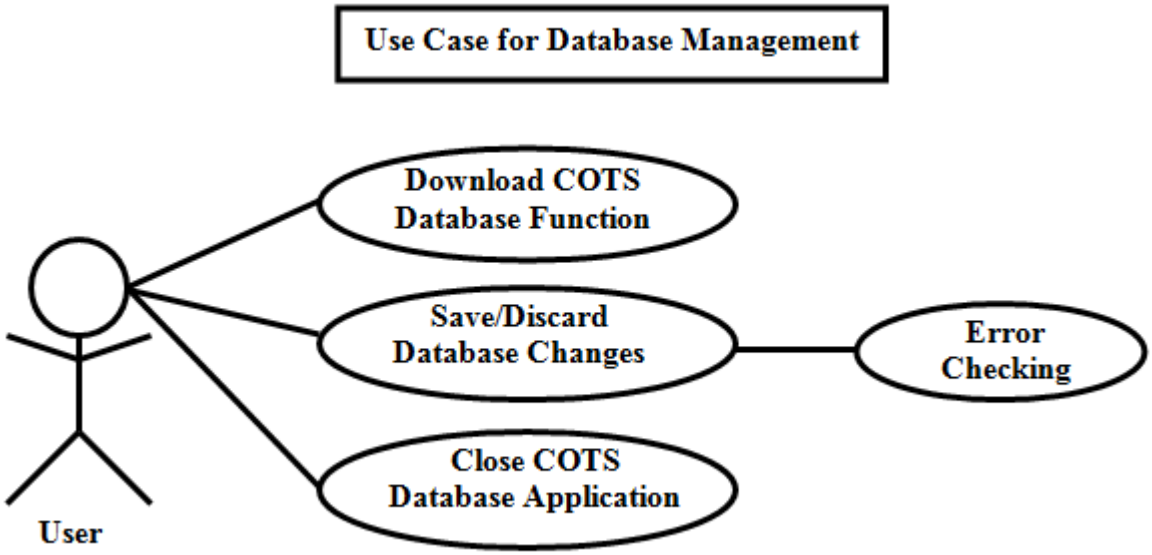
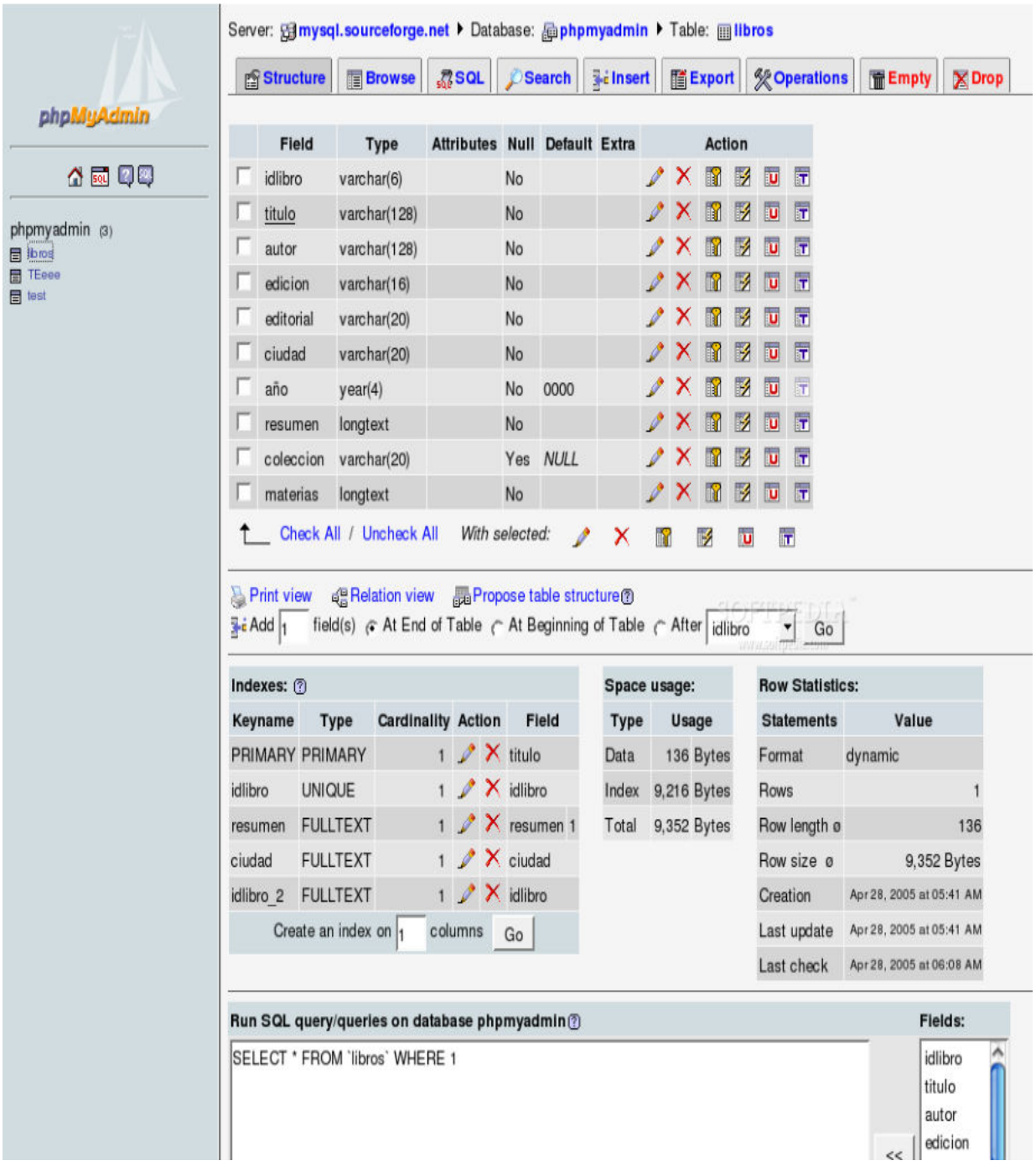


FIGURE 3.17 SCREEN SHOT OF COTS DATABASE GUI



3.4.6.3 Stimulus-Response Sequence

- The user selects the Database Management Module from the User Activity Menu GUI.
- The Database Management Module responds by returning the SWC Database in the COTS Product.
- The user utilizes the functions provided by the COTS Product to complete the desired tasks on the SWC Database.
- During the session, the user can save their current work from time to time on any of the provided storage mediums.
- When the user completes the current task or desires to exit the application, exiting the application is accomplished with the functions provided by the COTS Product. When exiting the application is initiated, the program shall query the user as to whether they desire to save the current work or exit without saving.
- The program shall execute the option selected by the user, terminate the current session, and return the user to the Activity Selection Menu GUI.

3.4.6.4 Use Case Diagram

3.4.6.4 Use Case Diagram			
Activity	**Agent**	**Stimulus**	**Response**
1	SWC Database		In response to the user request to use the Database Management Module, the program presents the SWC Database in the COTS application.
2	User	The user uses the COTS Database Application to create, modify, or delete database information in the SWC Database files. During the current COTS session or upon completion of the current task, the user may periodically save the task in any of the available storage mediums. The user activates the COTS save capability to initiate the save function and then indicates the storage medium to be used and the task	

3.4.6.4 Use Case Diagram			
Activity	**Agent**	**Stimulus**	**Response**
		identifier.	
3	SWC Database		In response to create database information, the COTS Software displays the functions associated with creating a database to the user. In response to modify database information, the COTS Software displays the functions associated with modifying a database to the user. In response to delete database information, the COTS Software displays the functions associated with deleting a database to the user. In response to the save action initiated by the user, the COTS Software saves the current session on the storage medium indicated at the location specified and returns the application access to the user.
4	User	When the user completes their current task, they request to exit the application.	

3.4.6.4 Use Case Diagram			
Activity	**Agent**	**Stimulus**	**Response**
5	SWC Database		In response to the exit request by the user, the COTS Software queries the user as to whether they desire to save the current session at the specified location on the selected storage medium or to exit without saving.
6	User	In response to the query as to whether the current session is to be saved, the user either declines to save or confirms to save by specifying the location name and the storage medium to be used.	
7	SWC Database		As directed by the user, the desktop executes the exit procedure and returns the user to the Activity Selection Menu GUI.

3.4.7 Initiate Web Crawler

3.4.7.1 Purpose

The purpose of the Initiate Web Crawler Module is to provide the user the capability to crawl the Internet for information specified by the user.

3.4.7.2 Functionality

The Initiate Web Crawler GUI is accessed by navigation through the SWC User Activity Selection Menu GUI. The user selects it by pointing or tabbing up and/or down to the *Initiate Web Crawler* button on the User Activity Selection Menu GUI and pressing either the *Submit* button or the *Enter* key on the keyboard. Through data entry, the user can set the crawl parameters for the Internet crawl. When the Internet crawl is done with its crawl, it presents the user with any matches found. The Initiate Web Crawler shall be called with the COTS Database Application and is presented to the user for user. During or upon completion of the activity, the user can store the current task in the PC memory. When the work is complete, the user closes the

application. The system shall prompt the user as to whether they want to save the current work or close the application without saving and execute the action selected. The COTS database Application returns the user to the Initiate Web Crawler GUI. See Figures 3.17 and 3.18.

FIGURE 3.18 USE CASE FOR INITIATE WEB CRAWLER

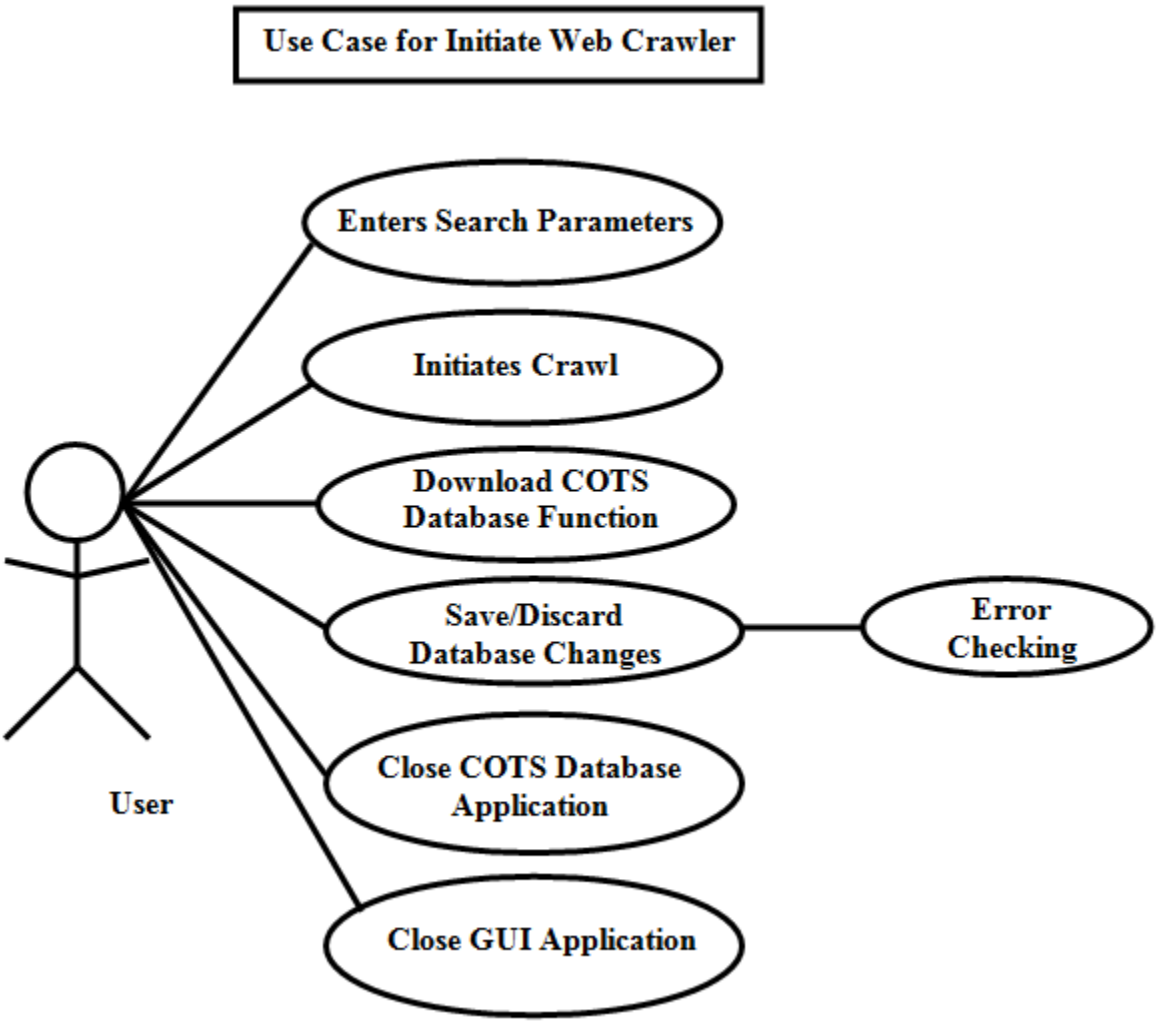
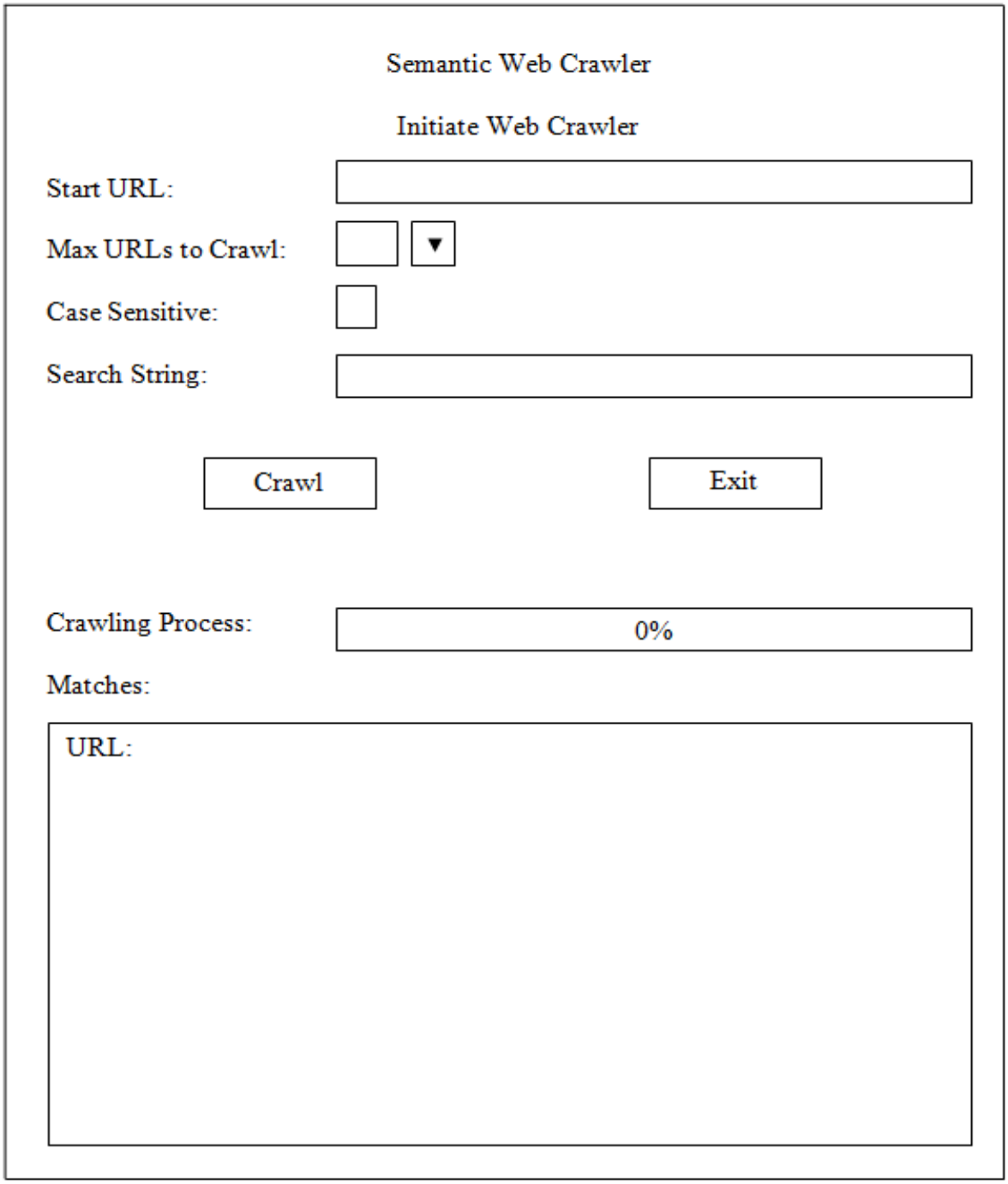


FIGURE 3.19 INITIATE WEB CRAWLER GUI



3.4.7.3 Stimulus-Response Sequence

- The user selects the Initiate Web Crawler Module from the User Activity Menu GUI.
- The Initiate Web Crawler Module responds by returning the Initiate Web Crawler GUI.
- The user, through data entry, sets the crawl parameters in the GUI and initiates the Internet crawl.
- The Initiate Web Crawler Module returns any matches found in the crawl.
- The Initiate Web Crawler Module responds by returning the SWC Database in the COTS Product.
- The user utilizes the functions provided by the COTS Product to complete the desired tasks on the SWC Database.
- During the session, the user can save their current work from time to time on any of the provided storage mediums.
- When the user completes the current task or desires to exit the application, exiting the application is accomplished with the functions provided by the COTS Product. When exiting the application is initiated, the program shall query the user as to whether they desire to save the current work or exit without saving.
- The program shall execute the option selected by the user, terminate the current session, and returns the user to the Initiate Web Crawler GUI.
- The user can either initiate another Internet crawl or exit the GUI by pressing the *Exit* button.
- The program shall execute the option selected by the user and either initiate another Internet crawl or return the user to the Activity Selection Menu GUI.

3.4.7.4 Use Case Diagram

3.4.7.4 Use Case Diagram			
Activity	**Agent**	**Stimulus**	**Response**
1	SWC Program		In response to the user request to use the Initiate Web Crawler Module, the program presents the Initiate Web Crawler GUI.
2	User	The user, through data entry, sets the crawl parameters and submits the crawl with either the *Crawl* button or *Enter* key.	

3.4.7.4 Use Case Diagram			
Activity	**Agent**	**Stimulus**	**Response**
3	SWC Program		The Initiate Web Crawler Module returns any matches found in the Internet.
4	SWC Database		In response to the matches found from the Initiate Web Crawler Module, the program presents the SWC Database in the COTS application.
5	User	The user uses the COTS Database Application to create, modify, or delete database information in the SWC Database files. During the current COTS session or upon completion of the current task, the user may periodically save the task in any of the available storage mediums. The user activates the COTS save capability to initiate the save function and then indicates the storage medium to be used and the task identifier.	
6	SWC Database		In response to create database information, the COTS Software displays the functions associated with creating a database to the user. In response to modify database information, the COTS Software displays the functions associated with modifying a database to the user. In response to delete database information, the COTS

3.4.7.4 Use Case Diagram			
Activity	**Agent**	**Stimulus**	**Response**
			Software displays the functions associated with deleting a database to the user. In response to the save action initiated by the user, the COTS Software saves the current session on the storage medium indicated at the location specified and returns the application access to the user.
7	User	When the user completes their current task, they request to exit the application	
8	SWC Database		In response to the exit request by the user, the COTS Software queries the user as to whether they desire to save the current session at the specified location on the selected storage medium or to exit without saving.
9	User	In response to the query as to whether the current session is to be saved, the user either declines to save or confirms to save by specifying the location name and the storage medium to be used.	
10	SWC Database		As directed by the user, the desktop executes the exit procedure and returns the user to the Initiate Web Crawler GUI.

3.4.7.4 Use Case Diagram			
Activity	**Agent**	**Stimulus**	**Response**
11	User	The user can either initiate another Internet crawl or exit the GUI by pressing the *Exit* button.	
12	SWC Program		The program shall execute the option selected by the user and either initiate another Internet crawl or return the user to the Activity Selection Menu GUI.