

# A Web-based Research Support System Enhanced

## With Wiki Technology

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## **Abstract**

Due to the growth of new technologies such as digital libraries, online databases, and web search engines, a new field of research, which is Web-based Support System, is constantly evolving. Researchers find it challenging to use online information resources. But web-based research support systems, based on computer science, information technology, and web technology, are able to assist researchers' activities. Wikis are new channels which enable people to post their opinions in diary form. These types of websites have characteristics such as the diary style, community support and automation which qualify them to play an important role in supporting researchers. Researchers are able to track the previous information in wikis because of the diary format. They can interact with other wiki pages due to the community support quality and because of the advantage of automation. They have the ability to create new wiki pages without having any type of programming skills. Therefore, this project implements a web based application to aid researchers to perform scientific research. A web-based research support system has been developed to assist the researcher via two major components. The components are wiki pages and assistant components to the wiki pages. The assistant components are the search engine, web page analyzing, search engine referrers, and forums. There are also other functions related to social networking which can enhance communication between researchers within the system.

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## **Dedication**

This work is dedicated to my terrific parents, my mother, Ghazwa, and my Dad, Khalaf, for their guidance, assistance, encouragement and supportive advice and lessons. Although my Dad passed away a long time ago, I still remember his lessons and encouragement. I would also like to dedicate my project to my terrific wife, Tasneem, for her assistance, patience, and unconditional love. I would also like to dedicate my project to my wonderful sisters and brothers for their generous financial support and moral support. Above all, I dedicate my project to the Almighty God who provides all I need while involved in my studies.

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# 1. Introduction

## 1.1 Problem Statement and Motivation

Designing a web-based system using Wiki technology to meet researchers' activities is the gist of this research. It will provide the research field with the ability to grow and extend in many directions. It will allow researchers to obtain the most benefits from the new technologies when they conduct researches. Further, researchers will obtain the full advantage of the combination of a web-based system on one hand and wiki technology on the other hand. Web-based research support systems will be the new research era because they satisfy the needs of the researchers [19, 26]. Wiki technology has proven to be an effective communication channel which will improve relations between researchers [8, 20]. Also, due to the diary form of Wiki technology, Wiki technology can record history which will affect researchers' efficiency [8, 26].

Furthermore, researchers face several obstacles in dealing with knowledge resources on the web. They are not able to explore helpful resources, extract useful data, and enjoy the benefits of the retrieved information [26]. There is also poor communication among the researchers, because they lack the appropriate communication tools. Therefore, group work research is not a successful method of conducting research and the quality and productivity of some researches is low. In this project, online information resources' challenges will be achieved. The communication tools for researchers will be far better and more enhanced. Moreover, the quality and productivity of the researches will be expanded.



## **1.2 Proposed Solution**

The web-based research support system in this project takes into consideration the obstacles researchers face, and researchers' activities. It might help researchers extract valuable data from the web via the search engine and guarantee the accuracy of the results within the search. It also provides analysis and statistics for the system's contents in order to permit researchers to understand some useful knowledge [19, 26]. It views the search engine queries and provides researchers with helpful information such as the most used word in queries which might prove beneficial to researchers in allowing them insight into the interests of other readers. Furthermore, it provides researchers with the ability to create wiki pages with which to display their researches. Therefore, the readers can edit a topic and add changes based on their opinion. It allows readers to comment on any article without a need to change it and to give approvers the ability to promote the research. Moreover, it provides an advanced forum in which to enhance communication between researchers and to allow different users to open discussions regarding different topics. This function can have some statistic tools which might enable this forum to be more advanced and different from other forums in other systems.

### **1.3 Organization of the Report**

This report is presented within six chapters, in addition to the first chapter, which is the Introduction. The evolution to a Web-based Support System (WSS), its characterization, its feasibility, and its scope are highlighted in Chapter 2. Moreover, the framework of WSS, the design of WSS, and the examples with respect to WSS are also contained in the same chapter. In chapter 3, the motivation behind the Web-based Research Support System (WRSS) is introduced. Furthermore, the supporting functionalities and the research activities in both levels are presented in Chapter 3. In Chapter 4, wiki technology and its role are displayed in addition to the success of weblog and the characteristics of diary forms. The proposed research support system is introduced in Chapter 5 which includes the search engine, web page analyzing, search engine referrers, wiki pages, the forum, and other features. In Chapter 6, software diagrams are presented containing software architecture, use cases, a sequence diagram, a component diagram, and a class diagram. The last chapter provides a summary of the report and recommended future work.

## **2. Web-based Support Systems**

### **2.1 Introduction**

The use of computerized support systems has improved with the emergence of new computer technologies [24, 32]. These types of systems focus on assisting and supporting different activities for system users [23, 25]. This support is concentrated in a particular field and based on specific knowledge around that field [28, 29]. In other words, computerized support systems are special systems which focus on supporting human activities in specific fields based on computer science [24, 31]. The evolvement of computerized support systems such as research support systems, medical teaching support systems, learning support systems, knowledge management support systems, and information retrieval support systems is rapid [25, 27]. Decision support systems are also an example of computerized support systems and are the most common [25, 31]. In this case, management science is the specific field in addition to computer science from the decision support systems [29]. Moreover, the previous examples are formed by a combination of computer science and the specific fields [24].

Web technology carries out different tasks such as storing, displaying, sharing, and processing information [25]. If the web's issues have been studied, new solutions and systems would appear to support human activities [28]. Furthermore, current approaches in web technology and their usefulness will be known [29] which will lead to pulling the computerized support systems to the web platform and then new types of support systems will emerge which are Web-based Support Systems (WSS) [27]. WSS concentrate on supporting human activities in particular fields utilizing computer science, information technology, and web technology [23]. They use computerized support systems and focus

on the same specific fields but they take advantage of web technology [24]. The result of studying WSS is finding new topics to search because the integration of web technology may lead to new areas which have not been examined previously [25, 31]. Additionally, the building of advanced and efficient systems will be a result of studying WSS [32].

## **2.2 Feasibility and Scope of WSS**

Computerized support systems are well designed systems. But the influence of these systems is not very wide because they assist only limited users. Web technology can move these systems to assist wider zones and to overcome their limitations. Therefore, integrating web technology with computerized support systems will be helpful to improve these kinds of systems.

One benefit in integrating web technology with support systems is the testing of current methodologies and observing the efficiency of their use with the web [29, 31]. Web technology can improve the functionalities of computerized support systems due to advantages such as [28, 32]:

1. Diversity in knowledge resources.
2. Being a good portal with which to communicate with others.
3. The ability to use it constantly and from any place without obstacles.
4. High security, especially nowadays, due to useable, high security software.
5. Having a non-difficult, friendly interface which can be used by everyone.

On the other hand, the scope of WSS is divided into four classifications: WSS for particular fields, web-based applications, techniques related to WSS, and the

development of WSS. First, WSS for particular fields focuses on assisting human activities in the particular fields of web-based medical support systems, web-based teaching support systems, web-based learning support systems, and web based information retrieval support systems. Second, the web based applications deal with supporting the WSS in several determined tasks such as web-based knowledge management support systems, Web-based financial and economic systems, Web-based financial and economic systems, and Web-based multimedia systems. Third, techniques related to WSS are special types of WSS that use several techniques in information processing and artificial intelligence to support the functionalities of WSS, techniques such as Web information management, Web information retrieval, Web data mining, and Web search engines. The last category is the development of WSS which includes systems used in the designing and building of WSS such as systems for building web-based applications, systems for analysis and design of web-based applications, systems for designing user interface, and security systems [31].

In brief, we can see that the classifications of WSS cover all the parts that important to build a support system which are the field that we want to support, the applications, the techniques, and the useful tools to build a system. Therefore, each designer who wants to build WSS needs to deal with all these classifications. In another word, all these parts should be considered in the stable WSS.

### **2.3 Development of WSS**

The traditional software is designed based on users' requirements and collecting the users' requirements is the first step in the software process. In web-based support

systems, the requirements of the users always change. Therefore, in designing web-based support systems, the designers must focus on several issues that affect the efficiency of the systems such as the ability of the systems to be maximized, the ability for maintenance, the accessibility, security, interface, and customization [24].

Before starting the design phase, designers should ask themselves several questions such as the scope of the system, assistance of the search, customization, functionality of services and tools, networking, and evaluation of the system in order to determine the reasons for building the system [24].

Furthermore, designers should think about the types of users who are able to act in the system, and their roles. Designers should consider different kinds of users such as the administrators of the system, the permissioned users, and the anonymous users. The administrators are users who have the ability to change and update anything in the system including the layouts and the organization. They can add, delete, and update any content in the system. In addition, they can give permissions to other users. The permissioned users have the ability to execute several permissions that were assigned by the administrators such as creating, updating, and deleting contents. The anonymous users can view the pages and the contents of the system and in several systems they can comment.

The management of data in web-based support systems is divided into three categories: the structure data, semi-structured data, and unstructured data. Structured data is the data which is stored as objects in the databases. Semi-structured data is the data in web format. An example would be XML files which are files that can be read by humans and machines. The last category is the unstructured data which is the most

difficult type of data to be stored and is indefinable in the databases. On the other hand, the SQL queries can be used to process the structured data. As for the semi-structured data and the unstructured data, the SQL queries can be used as well, if this type of data is transferred to the structured data. Otherwise, the designers should create another type of query when utilizing semi-structured data and unstructured data. The WSS have different query techniques such as scheduled queries, ad-hoc queries, information seeking queries and activity support queries [24].

The three main variables in designing a WSS should be taken care in order to build a system that can deal with the huge changes in support systems. Those variables are the user requirements, the type of users, and the data. Dealing with data is the most significant part in the WSS due to the importance of data in WSS and also it is the core of building these types of systems.

## **2.4 A Framework for Web-based Support Systems**

Designing any system consists of several layers such as the login layer, business layer, and database layer. These layers are based on the analysis phase and the user requirements' phase. All the phases in the software process are essential and depending on each other. But the design phase is the most essential one because it can display the components of the system and in this phase the actual system starts to be seen.

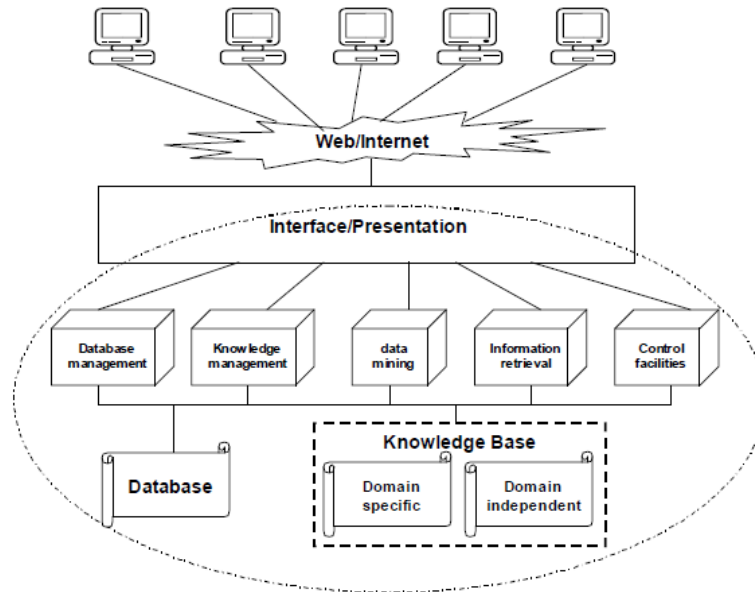
The design of WSS contains three major layers - interface, management, and data. The interface provides access through the internet to different users and the type of user depends upon the specific field of WSS [25]. The management layer includes database management, knowledge management, data mining, information retrieval, and control

facilities [29]. This layer is the core component in the design of WSS and it works as a medium between interface and data layers [28]. The sub-components of this layer work on the web technology in order to gain beneficial advantages [25]. Information retrieval deals with search and indexing functionality [32]. Users can access via the interface to search the databases and knowledge base. Other control facilities contain two main parts - security and permissions [31]. The data layer consists of two parts - database and knowledge base [28]. The databases store all the data in the system via the management of the databases in the previous layer [29]. The knowledge base stores all the rules retrieved from the data mining which is the sub-component in the previous layer [31]. In WSS, the knowledge base is divided into two types of knowledge - dependent knowledge on the domain with determined knowledge related to the domain, and independent knowledge with common knowledge between WSS [32].

The business layer or what we call it in this framework the management layer is the gist of any design. Because it has all the major activities in the system and it is the link between the interface and the storage components. In this framework, this layer is more significant than usual because it has data mining, information retrieval, and data/knowledge management sub-components. WSS will not consider as support systems with out these main sub-components.

WSS can be divided into three levels of support - individual support, institutional support, and network support [28]. Individual support deals with assisting individual activities, Institutional support deals with assisting organizational activities, and Network support deals with communications between different institutions [19, 26].





**Figure 1.** Architecture of Web-based Support Systems [31].

## 2.5 Summary

The Web-based support system is a new research area which is a combination of computerized support systems and web technology [32]. RSS became quite popular and resulted in further efficient systems because of the qualities of web technology [24]. Moreover, RSS can test its methodologies within the new platform which is web technology [29]. WSS is supporting human activities in a particular field based on computer science, information technology, and web technology [31]. The scope of WSS is divided into four classifications - WSS for particular fields, web-based applications, techniques related to WSS, and the development of WSS [25]. The development of WSS needs to focus on the scope of the system, maintenance after the design, security, and data management [24]. The design of WSS includes several layers beginning with the

users and up to the storage layer, through the interface layer and the management layer [29]. The management layer contains database management, knowledge management, data mining, information retrieval, and control facilities [28]. The storage layer contains two sub-components - the database and the knowledge base [32]. The support can be classified into three classes - individual level, institutional level, and network level [31].

### **3. Web-based Research Support Systems**

#### **3.1 Introduction**

Research is one area which requires sustainable enhancement because it is a fundamental issue in every subject. Without improvements to scientific research, all the majors will not evolve and they will stay in constant case. In addition, improving scientific research will help scientists and researchers across the world [19, 26]. Web technology is constantly growing and then, one day a new field, which is called web intelligence, appeared as a part of computer science. Web intelligence gains benefits from the qualities of the web in order to build intelligent web information systems. On one hand, we cannot make computers think like humans but we can use computers to support humans [19]. Therefore, in this chapter we will focus on a Web-based Research Support System (WRSS) which is a combination of Research as a specific field and Computer Science, information technology, and web technology [19, 26]. The field of web-based research support systems is a part of the web intelligence [19]. The goal of studying WRSS is to create new systems to assist scientific research activities in research management offices and scientists and to enhance the properties of the researches and the quantity of research. In order to build an efficient research support system, the research activities must be understood. The research activities are categorized into two levels - the institutional level and the individual level. The institutional level deals with research activities within institutions which will result in improvement to researches' institutional work. The individual level deals with individual researchers' and scientists' activities in addition to the research process that will lead to assistance within each level of the research process in order to enhance the outputs of the process [19, 26]. The

consequences of studying WRSS are new theories, technologies and tools for assisting research based on web technology [19].

### **3.2 A Model of Research Support Systems**

Supporting research offices and the research itself are two major services to enhance the scientific research. Both of the research offices and the research itself are dependent on each other. Researchers will not find help without research offices and the research offices are useless without researches. Therefore, considering the two services is essential in creating a model to assist the research.

Based on the two levels of activities, which are the institutional level and the individual level, Tang et al, have proposed a model of research support systems. As an example, a university is taken into consideration to ease the understanding of the model. The university provides two types of services, one for research management staff and the other for individual researchers. The first service offers help such as management assistance for the offices and giving advice to the researchers. The second service offers help to the researchers as it relates to the actual research process [19].

#### **3.2.1 Research Support for Management Staff**

Research support for management staff offers assistance such as management assistance for the offices and giving advice to the researchers. According to Yao, there are four models for research management - one central office, multiple central offices, no research office, and a partial research office. The first model, being of one central office,

or as it is called “a one stop shop”, deals with all the administrative aspects of research through a single office and implements the “principle of central” to manage the research process. Some of the offices include the financial issues as well as their tasks [19]. The second model which consists of multiple central offices requires more than one office to deal with the administrative aspects of research. The relations' offices are involved in this model which deals with technologies, businesses, and marketing. The third model, which consists of no research office, manages the research process without a private office to execute tasks. So, with respect to this model, instead of having a private office to administer the work, the main office of research can take care of the administrative tasks or any other office. The fourth model, which consists of a partial research office, is a central office dealing with components of the research management tasks. Usually, the components are related to financial tasks such as funding. In general, research management services are divided into two areas, offering instructions and information to the researchers, and providing management support for researchers and sponsors. Based on these types of services, the research process is divided into three phases - survey and proposal, research and development, and summarizing and evaluation. In the survey and proposal phase, there are several tasks such as finding the topic of interest, exploring the problems and searching for possible solutions, and stating the proposal. The research and development phase includes many tasks such as conducting the research plan, collecting data, analyzing the data, finding useful tools, simulation, and testing. The summarizing and evaluation phase consists of providing the outputs, assessing them, displaying the scientific papers, and presenting future work. WRSS should cover researches' needs such as the need to investigate possibilities for funding and presenting proposals and the need

for information retrieval assistance to researchers in the research management offices in order to give them the ability to retrieve valuable knowledge, acquire a platform to conduct implementation, testing, and experimentation, and the need to facilitate management issues for leaders [19].

The research activities need to have attention from the institutions and the individual researchers. One of the two branches will not improve the scientific research alone without the other branch. Supporting individual researchers having more attention than supporting the research offices but in this model both of the branches have been covered. Moreover, this model has covered all the types of research offices.

The design of WRSS includes four components which are research management, information retrieval support, resource sharing support, and collaborative research support. Also, the design consists of three layers - infrastructure, the application system, and user access control. The infrastructure layer includes the base components of the sub-components in the application system's layer. The application system's layer includes the four main components in the design which are the core of the system. The user access control contains the access page and the access control [19].

### **3.2.2 Research Support for Individual Researchers**

Researchers run up against many obstacles such as information overload, misinformation, retrieval, and browsing tools when they use web-based information resources. The study of (WRSS) is trying to find solutions to these problems. (WRSS) is a combination of Research Ways, Computer Science, and the Web [26].

First, let us explain the Research and its process which initiates with the initial research idea and ends in exhibiting the results.

1. Idea-generating phase:

The ultimate reason for this phase is to find an interesting idea. The ideas always come from the readings and a curiosity regarding life around us. Searching through search engines is a fundamental method in this phase [1, 14].

2. Problem-definition phase:

The reasoning behind this phase is to gain a handle on the problem and define the exact problem which was discovered in the previous phase. This phase will help researchers to present impressive research. This phase is the most important phase in understanding research [19].

3. Procedure-design/planning phase:

The reason behind this phase is to make a plan to solve the problem and to imagine a simple design for the solutions [1].

4. Observation/experimentation phase:

The reason behind this phase is to find useful data, to watch phenomenon related to the topic, and conduct experiments [26].

5. Data analysis phase:

Analyze the collected data and the experiments' results from the previous phase in order to obtain helpful information for the next steps [19].

#### 6. Results-interpretation phase:

The main role of this phase is to gain benefits from the analyzed information, as taken from the previous phase, by creating theories and models to explain the results [26].

#### 7. Communication phase:

The Communication phase presents the research results to other researchers so they can change it or gain new ideas regarding the research. It is an excellent way to assist researchers in improving their researches so they can better understand future results. Also, the researchers can read others' publications and offer them some advice [19].

Sometimes, researchers use these steps, as in the previous order, and sometimes, they combine the steps in order to create fewer steps or extend them to create more steps. That relies on the researchers in some cases or on the researches in other cases [26].

Yao has proposed research supporting functionalities, based on the research process, in order to support researchers in the previous research phases [19, 26].

#### 1. Profile management:

It has modules which can find, organize, and save all information related to the research project and the researcher. In another way, profile management is separated into research project profile management, and scientist profile management. The modules can store the profiles in different formats such as databases, text documents, or XML documents. This function is to support the researcher and the project [33].



## 2. Resource management:

Human resources, tool resources, and information/knowledge resources are the types of resources which support research. Finding experts, storing them in a reservoir, and maintaining the reservoir are the functions in Human resources. Tool resources and information/knowledge resources have similar functions such as information retrieval, digital libraries, and databases. They can use web search engines for information retrieval [33].

## 3. Data/knowledge management:

Data/knowledge management uses modules to save, retrieve and find beneficial data along with databases and some valuable systems to deal with the data [33].

The following are some supporting functionalities:

- Exploring support:

This kind of support deals with extracting data and doing just minor analysis in order to provide useful ideas to the researcher. Then, it passes the results to the other support functionalities to do the major parts in the analysis.

This function is very important with respect to giving a researcher a clear idea regarding a topic by exploring the databases, libraries, and the web and by using machine learning and data mining, the researcher is given analyzed data [19, 26]. In addition, using agent technologies for searching reveals valuable data [19, 33].

There are different ways of extracting data from the web, but the following approach is accurate and reliable. It deals basically with taking labeled instances from the user in order to build a wrapper. To confirm that the wrapper is accurate, the user initializes the group of instances and the induction system can recommend some pages to be labeled. The results of the wrapper induction system are a group of extraction rules. These rules explain the method of placing the wanted information on the webpage. The wrapper verification system then learns many patterns from the wrapper which can explain the extracted data. If a change happens to the webpage, the system uses the patterns to update the wrapper and to repeat the whole process. The sources, which are processing in the wrapper, are either in implicit underlying structure or in a very regular structure. The wrapper results in an extraction of rules which are placed at the beginning and the end of the part which is taken from the webpage. That process is based on the landmarks, and each page contains several. There are landmarks such as words, numbers, and HTML tags but some sources cannot be wrapped due to their dependence on the landmarks. Therefore, there is an induction system based on the greedy-covering inductive learning algorithm. This algorithm uses few labeled instances by the user to extract rules. In the verification system, the patterns display a structure of ordered words and can be classified in different categories depending upon the type of word. For example, numbers belong to a numeric class and alphabets belong to an alphabet class and so on. In updating wrappers, the approach uses a re-induction algorithm if a change occurs and takes the starting and ending patterns and learns them. Then, it learns the segments in the new pages which are between the starting

and ending patterns. Then, it categorizes these segments into categories based on their similarities and compares the categories of the segments with the instances to find the change and update it [13].

In brief, there are several ways to extract data from the web and the way that I have explained in previous parts is beneficial and helpful to use in the exploring component in the WRSS. The most important quality of that way is the stability and the flexibility of changes. Data on the web is changing all the time and having a characteristic like that is so important.

- Retrieval support:

In this part, finding more data will be taken care in order to provide helpful information to the researcher. It deals with the ideas from the exploring support and also it finds new information through the latest technologies and techniques such as search engines, digital libraries, information retrieval, and data mining.

The main role in this function is to search and organize related information from the explored ideas [19, 26]. Moreover, the references could be considered as a standard with which to provide a classification to the scientific researches [26, 33].

Digital libraries provide users with accurate knowledge at any time and with unlimited space. Wiki technology can play an important role in retrieving efficient information from digital libraries and rapidly because it has qualities such as the sharing of information, tracing history, and checking records [10].

This model uses data mining algorithms such as the Eigen value selection algorithm and the association rules algorithm to extract valuable knowledge from

the data [10, 20]. It also combines wiki technology with a traditional retrieval system. Previously in the traditional retrieval system, users would search twice for valuable knowledge and that consumed lengthy periods of time. One search by using keywords and the results would be in the thousands. A second search using the results was to find valuable results. Therefore, using wiki technology is helpful to mark the retrieved results with different weights by characteristic parameters. This model has three layers: the application layer, the service layer, and the storage layer. The Service layer is the main concept in this model because it includes the major processes during the retrieved information. It takes the queries from the users and facilitates the complicated information. Then, it matches the queries and the description data in the libraries to return the results again to the system. It marks different weights to the results based on the characteristic parameter, which came from the data mining, to the comments and the records. Finally, the weighted results return to the users to give him/her more accurate outputs [10].

In order to evolve information retrieval we must involve users with the systems because some of the major steps in the retrieval process, such as writing the query, choosing from the results, organizing the results, and understanding them, are made by users. Therefore, the next generation of retrieval systems is retrieval support systems which concentrate on searchers' activities in terms of information and retrieval systems. With respect to information, web-based information retrieval support systems focus on presenting searchers' interests in order to influence search activities and represent the information to assist the searchers' understanding. In the

systems, web-based information retrieval support systems can deal with system preferences and the history of searches [7].

The Semantic wiki search is another useful method of retrieving information. In this approach, users write the queries in an ordered set of words and they obtain results in different interpretations from which to choose. It is a development towards semantic media wiki. The complex information in this approach can be viewed in an organized way. Its goal is to develop wiki platforms to represent the organized information. The major component in this approach is the typed links because it is responsible for creating organized information. In conducting a semantic search, the user creates information needs without paying attention to any knowledge regarding formal query languages. Then, the query interpretation uses keyword translation to translate the required information for conjunctive queries. Then, the user selects the best query that is closest to his need. Ultimately, the results return to the users to be accepted or to be refined by a faceted search [4].

In brief, retrieving valuable knowledge from the information sources is a shared responsibility between the user and the retrieving techniques. Data mining and enhancing the users' queries are helpful and can play important roles. The retrieving techniques can assist the users and facilitate the job for them. But users can do a great job if they know how to deal with these techniques.

- Reading support:

Improving the reading skill and enhancing the results that come from the reading is possible through some trainings and methods. Moreover, there are several

techniques that the reader can learn to evolve his/her reading. Thus, the major responsibility will be on the reader to get beneficial from explored and retrieved information. In another hand, there are many techniques to support readers some of them will be introduced in the coming paragraph. The main purpose of these techniques is to facilitate readers' work.

The main role of Reading support is to support the reader in finding valuable and related materials to his topic. In this function the reader can add bookmarks, make notes, and link different parts of an article. Also, connect different parts from different articles. Moreover, to support the reader, we can use text mining and machine learning. Also, we can use agent technologies to search out information. Finally, online dictionaries can be used as well [19, 33].

Several evaluation tests can give us an overview of the online reading behavior and process. For the most part, the tests depend upon multiple choice questions, comprehension questions, and short essays. In order to conduct a sufficient evaluation of the reading behavior, we must focus on the performance of the readers. The behavior of readers is a set of actions executed by readers when they read. The readers write keywords into search engines. The search engines come back with relevant results to the readers' queries. Then, the readers begin to read in the web page and write down useful information for themselves. An assessment of online reading is conducted by observing these processes and categorizing them in order to evaluate them. Thus, this is a prototype system that can observe online reading processes. Three main components make up the systems analysis phase in

order to combine the reading activities, embed mechanisms for data collection, and integrate the assessment mechanism [5, 16].

The first component is the online reading accessories which have three parts: access to the browser, a part for reading, and a part for writing notes. The second component is the Latent Semantic Analysis (LSA) which is a technique to build a semantic representation of a part in a text and categorize it. This component is used for the evaluation of contexts. The third component is Verbatim Quotient Detection (VQD) which is used mainly to extract URLs from the internet resources that have been visited during the reading process. Moreover, it retrieves data from the visited resources and compares the results with the written part from the reader in order to verify there is no copied verbatim. The verbatim copied in this system, is explained as any five or more words beside each other [5, 16].

As a summary of the reading support, there are several techniques to support reading in order to provide valuable resources to the researchers. But changing reading's behavior of the readers is very essential issue.

- Analyzing support:

There were some data analysis's tasks in the exploring support and retrieval support. But in the analyzing support, the major data analysis' tasks will be held. This functionality can be helpful to other functionalities such as exploring support, retrieving support, and reading support.

The main role of Analyzing support is to support the reader in using the most suitable tool to solve a problem. This function should explain the tool and how the reader can use it. This explanation can be shown as a text. Also, using visualization and graphics should prove helpful. The problem with visualizing data is that the exposed data is only a small amount. In order to solve this problem, we require a visual data explanation and information visualization techniques, which deal with presenting data in a visual form. In addition, data mining can play a role via contributions from humans in order to gain beneficial information from human abilities in the data exploration process. The whole idea of the process is to display data visually and offer the analysts the ability to explore the data and deal with it [11, 12].

Visual data mining techniques are used to explore large databases when the information regarding the data is minimal and when the exploration goals are uncertain. Visual data exploration is a three-step process: overview, zoom and filter, and details-on demand. In this process, users define interesting patterns and analyze them in order to explore the details of the data. Visualization techniques could be separated into categories depending upon three standards: the targeted data, the technique, and the relation between data and technique [18].

In brief, databases have huge amount of data especially the large databases. This data is still raw until analysis occurs to it. Then, the data will be transferred to useful knowledge. There are several techniques to analyze the data, visual data mining is one of them and it is very helpful because it displays the results visually.



- Writing support:

Writing support consists of using word processor, spell check, and grammar check to support the writer. It also incorporates the use of retrieval support systems to look for articles based on text or to find references [19, 33].

### **3.3 Conclusion**

The study of web-based research support systems deals with taking the qualities of web technology and applying them in order to support a scientific research area and improve the methodologies and systems of existing research support systems. Assisting the scientific research area could be done by supporting the research management offices and individual researchers. Therefore, the research activities are categorized into two levels - the institutional level and the individual level. The first level deals with assistance for the institutions and the second level deals with assisting individual researchers by providing support to the research process. A model of a research support system was proposed to include research support for management staff and research support for individual researchers. The first model is to provide instructions and assistance to researchers and also to manage the works of the research management offices. Based on these services, the process of the research is divided into three phases - survey and proposal, research and development, and summarizing and evaluation. One central office, multiple central offices, no research office, and a partial research office are the types of offices under the

research support for management staff. The research support for individual researchers includes functionalities such as exploring support, information retrieval support, reading support, analyzing support and writing support to support each stage of the research process [19, 26].

## 4. Wiki Technology

### 4.1 Introduction

A wiki is a set of web pages created via the contributions of many people and improved sustainably by the same people. It is a group of web pages linked together and formed by a group of users who improve these pages cumulatively. The software of wiki pages is used to administer and manage the group of web pages. They have some main characteristics such as they allow some authors for one article, they are implemented by the simple language of programming such as HTML, and they have freedom of publication. To create a wiki page, the writer can use web form to enter the article which he/she wishes to publish. The writer has the choice of choosing the style of the text and also the type of text such as plain text, mark-up language, and HTML. Hyperlinks play an important role in wiki pages as they link all the pages and are one of the principles used in designing wiki pages. Wikis hyper linking is easier because we do not need to make URLs [21]. Wiki's design relies on eleven principles made by Ward Cunningham [21]:

- Open: Any reader can edit any page he/she wants.
- Incremental: pages cite each other, even the unwritten pages.
- Organic: the content can be edited and evolved.
- Mundane: non-useful pages lead to useful pages.
- Universal: Any writer is an editor at the same time.
- Overt: The main article and the edited articles are both shown on the page.
- Unified: The page names are clear.
- Precise: Choosing the titles of pages should be precise.

- Tolerant: easy to understand.
- Observable: any visitor can watch all the activities in the site.
- Convergent: duplication is forbidden and similar topics should be deleted.

## **4.2 Wiki Characteristics**

Web pages have some characteristics allow them to play important role to support researchers. But these characteristics are not enough for the collaborative work. Therefore, wiki technology has been created and supported researchers in that type of services.

Wiki technology is a new channel of communication wherein authors publish their works and share them with their readers [2, 6]. It allows incomplete ideas to be completed by interested readers and ultimately published. Therefore, the content of the wiki pages is a collaborative work by many readers. In order to find the best version of the content, check the last version containing all the changes. It allows readers to work as a group and edit and change other articles for other authors in order to enhance the article [21, 26]. So, it is community supported because it interacts with other wiki pages [20]. It is available at any time and in any place as long as the user has internet access. Hyperlinks in wiki pages are different than normal web pages because, with one click on the hyperlink, the user is able to move between different wiki pages to another page very easily [21, 24]. Wiki technology is personalized for personal use in a casual style. It is web-based and spread across the World Wide Web. It is automated which allows users to concentrate on the content without worrying about programming [17, 20]. Wiki is “many-

to-many technology” which means many people participate in order to evolve the project and then publish it so it can be shared by many people [21].

One of the most important characteristics for wiki technology is being personalized and also it is many-to-many. We conclude from those two characteristics to that the owner of the wiki page is one person at the beginning then the right of the article will move to everyone who edited on the article. But there are some rights should stay with the main author in order to keep the articles organized.

### **4.3 Wiki Applications**

What differentiates wiki pages from regular web pages is that allowing users to work as a group and assisting them to do so via the wiki system. Therefore, the main purpose of wiki applications is accomplishing those two principles in order to promote users.

In this section, two types of applications will be described. The first application is applied to collaborative works and the second is to implement guidance sub-systems. The first application can help with systems which are forever changing content. The second application can help where systems have different points of view regarding the content. The collaborative works' systems have changed the idea of physical meeting to the idea of digital meeting. So, all the activities in a meeting such as brainstorming, idea generating, and voting to make decisions could be conducted in the digital meetings. Wiki pages have many qualities such as many-to-many creating and sharing information and organizing by topics rather than in chronological order which allow the system to

play an important role in this type of application. The best approach to avoid misunderstanding in the brainstorming stage is to allow users to just comment on each others' works. After all the ideas have been submitted, the users can be authorized to edit, thus, giving the users the ability to think together [21].

Guidance sub-systems can be designed by defining basic questions at the start. Then, the questions will be divided into several questions to help additional users. The aforementioned types of systems can improve themselves by taking into consideration new questions and answers from users, readers, and editors. The obstacle herein is if users continually ask the same questions, then improvements to the system will end [21].

Using the main functions of a system and finding a help when it is needed are all what the users need from any system. Wiki systems provide these services in order to ease using the system for the users. Enhancing these services is what differentiates between the different systems.

#### **4.4 The Implications of Wiki**

Wiki technology assists the collaboration work in groups. To facilitate this mission, it supports the main author and the editors to work as group. Also, it deals with the help centers' applications to help users of the wiki systems.

Wiki technology has changed the idea of an author owning an article. In the articles that are written in wiki technology, there are many authors for one article who are the editors and the first author. Moreover, wiki gives free right to anyone to edit any

article which creates a balance between spam and useful editing in order to give value to the articles. On the other hand, some wiki applications have a help center which provides instructions to the editors so they become familiar with the method of editing and thus, are able to enhance their editing. Wiki applications help benefit the whole system, in making the content readable and valuable to readers [21].

#### **4.5 Blogging Tools**

To achieve the wiki principles and to support the collaborative work, blogging tools are needed to be used. These tools will assist users to deal with the wiki technology and to get beneficial from it. They act to do different functionalities and they are classified based on them.

Wiki pages and blogging tools provide capabilities to users to create such pages. The tools are categorized into three main categories which are tools to create basic information types, tools to create more than basic information types, and tools which include advanced applications to enhance social networking. The first category has basic features for blogging which allow the user to simply post the content. It contains only text contents, so it does not deal with pictures or videos. Its user interface is not rich, so it is clear and everything in it is easy to learn. However, at the same time, it does not have numerous functionalities. The second category has a rich interface which deals with more than text contents such as multimedia. The second category allows users to manage the contents by commenting, editing, or hyperlinking. Also, it has some functionalities such as referencing for other resources and trackbacking for hyperlinks to track the pages

behind that hyperlinks. This category is the most popular category in current blogging tools. The third category deals with advanced software to increase social networking activities such as alerts to the users, latest activities of other users, sharing videos and music, and updates through emails [20].

The second category has most of the functionalities that WRSS need and the third category has more than that. Therefore, designers who want to build WRSS need to deal with either the second category or the third category. In another hand, the first category will not be helpful in building WRSS because the research activities need more support than only posting text contents.

#### **4.6 The Role of Wiki in WRSS**

Web-based research support systems are an area wherein one is able to study the assistance of research activities based on computer science, information technology, and web technology. Integrating Wiki technology into building web-based research systems could be useful due to the qualities discussed previously. Wiki technology can play very important roles in supporting research activities and their roles will be explained hereinafter. Wiki technology records the history and the evolution of the research. Therefore researchers can trace the history and recognize the previous steps exactly and predict forthcoming steps. Furthermore, it provides tracking for new posted articles in order to inform users and readers about new articles in the system. It gives users the ability to comment in the form of brainstorming and generating ideas. Spam comments and unorganized editing are two major obstacles to wiki systems, but they can be



overcome by delaying the comments or giving the author the control to delete or review the comments. Also, they can be avoided by allowing only permissioned users to contribute. Wiki technology provides a new method of publishing which is accepting even incomplete projects, thus, allowing the project to be completed by the editors and the commenters. Hyperlinks in wiki technology are making the citation more helpful to readers because, with one click, the reader can move to the reference. In addition, the hyperlinks in wiki technology can link different wiki pages. The organization of wiki pages is useful to readers because wiki technology organizes the system by topics. Moreover, the organization has more functions than the classification system such as making backup copies of the system and retrieving contents from the wiki pages. Finally, searching across the system and across the wiki pages is usually available within systems that use wiki technology [26].

#### **4.7 Conclusion**

Wiki is a set of connected web pages created by a group of users who evolve these pages cumulatively. Building wiki pages is not difficult due to the wiki pages' systems which are automated and easy to use [20, 21]. Wiki pages have several characteristics such as being a new way of communicating, allowing collaborative work, and are supported by a community of users [6, 20]. Certain systems use wiki pages and focus on the collaborative work if they involve changeable contents. Other systems work as guides for many systems, use the wiki pages and provide guidelines to users. Wiki technology has shifted many paradigms in web technology such as the idea of only one

author per article. So, it gives the ability to many users to edit an article and contribute in writing the article. Moreover, it provides support systems to the editors in order to facilitate the editing procedure and guide them in the right direction [21]. There are three classifications of blogging tools which are tools to provide basic contents, tools to provide more than basic contents, and tools to provide advanced applications to support social networking. Wiki pages play an important role in web-based research support systems due to the following qualities: recording the history of the project, tracking new posts, allowing users to comment and edit, preventing spam comments and edits, accepting citation information and hyperlinks, managing the contents, and allowing users to search across the system [20, 21].

## **5. A Wiki System to Support Researchers**

### **5.1 Introduction**

New technologies such as digital libraries, online databases, and web search engines are constantly emerging and can affect the growth of scientific research. Researchers face several obstacles when they use online information resources. The field of Web-based research support systems manages issues and studies to assist researchers' needs in order to accomplish these challenges. Wiki technology is a new area and can influence the research process and the phases of conducting research in order to enhance the quality and the quantity of researches [26]. Wiki technology can play that particular role because of its qualities, which distinguish it from other technologies such as the diary style, community support, and automation [2, 20]. By integrating wiki technology into a web-based research support system, the outcome will be a system that meets the needs of researchers and offers the advantageous benefits of the wiki [25, 31]. A wiki system to support researchers has been developed to support the researcher and the research process via the two major components of wiki pages and supporting components to the wiki pages. The supporting components are a search engine, web page analyzing, search engine referrers, and forums.

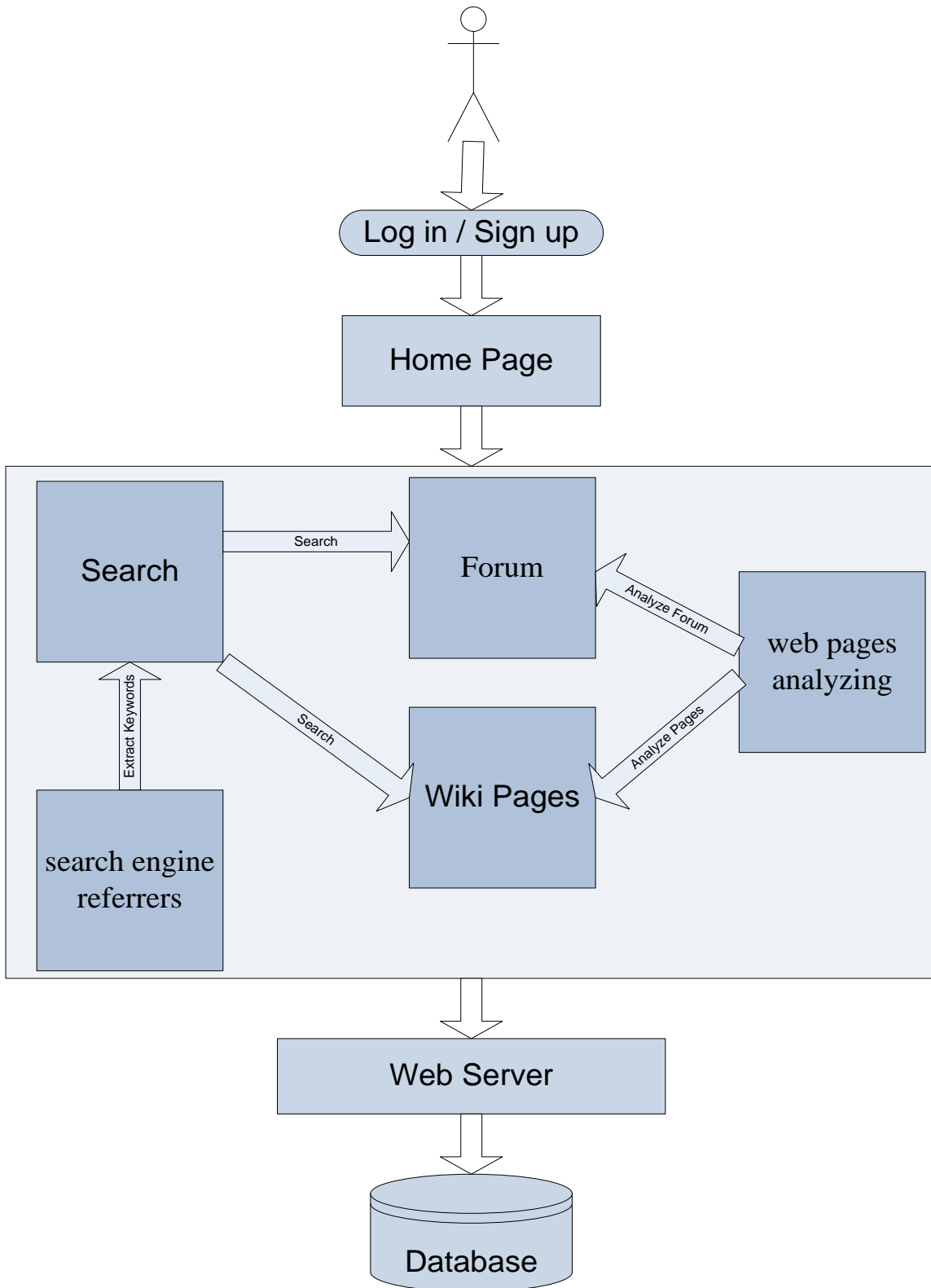
### **5.2 Problem Description**

Researchers face many obstacles in using some technologies such as digital libraries, online databases, and search engines when they manage knowledge resources on the web. The obstacles are usually in the areas of exploring, discovering, and

retrieving knowledge. They cannot easily extract helpful information and process this information to gain useful results. Researchers also find it challenging to communicate with other researchers due to unsuitable communication tools. Designing a web-based system to facilitate the work of researchers is needed in order to increase the productivity of the researches. Wiki technology works as a connection approach between its users [6, 26]. It can evolve the collaborative work within the research groups to enhance the scientific researches [21]. The combination of a web-based system that focuses on assisting research activities and wiki technology will lead to a strong system that overcomes the researchers' obstacles and enhances research efficiency.

### **5.3 Software Architecture**

Software architecture is the main diagram that shows the major components and the layers of the system. Furthermore, it shows the relationships between all the layers of the system from the actor which is the user of the system until the storage layer through the client layer and the business layer which contains the main components of the system.



**Figure 2.** Software Architecture

Figure 2 exhibits the homepage where a user can log in using their username and their password. Then the user can use the main components of the system which are the wiki pages, search engine, web page analyzing, search engine referrers, and forum. It shows the web servers where the databases are located. Furthermore, it displays the databases where the wiki pages, forum topics, and statistics of the system are stored.

#### **5.4 A Wiki System to Support Researchers' Research Activities**

A Wiki System to Support Researchers is found within the field of web-based research support systems, a field wherein technologies and methodologies are studied to assist research activities in institutions and also for individual activities [19, 26]. The WRSS is part of the web intelligence area which is based on artificial intelligence studies, methodologies and algorithms in order to build Intelligent Web Information Systems (IWIS). WRSS is one of the IWIS [19]. This system includes two main components which are wiki pages and supporting functions to the wiki pages' component. The supporting functions are intended to support the first component and system users in many aspects. The supporting functions are the search engine, web page analyzing, search engine referrers, and the forum. In the following sections, the components of the system and the supporting functions to the first component will be described in detail.

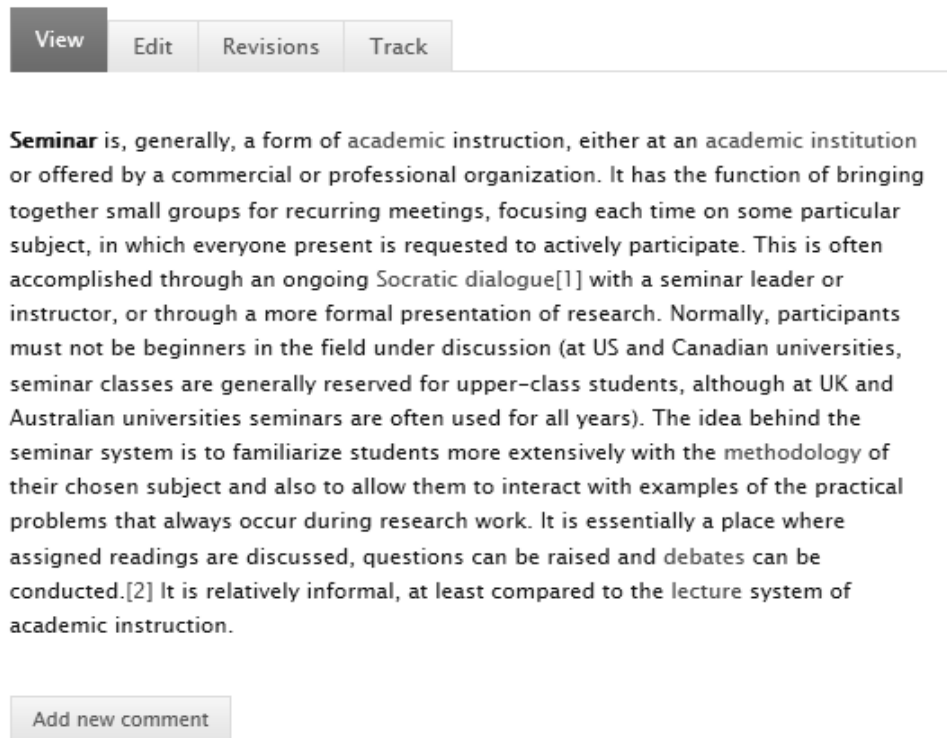
##### **5.4.1 Wiki Pages**

This component allows researchers to create wiki pages in order to express their ideas and to publish their researches. It forces researchers to choose unique titles when they write their articles in order to avoid confusion within the system. Thus, different

articles, having the same title, are not allowed in this system. Moreover, changing the title of an article is restricted and only allowed if permission is given for the change. So, organization of the articles is guaranteed. Then, changing the title of an article will happen only in specific cases. Searching through articles is allowed so users can find new posts or articles of interest via the pages of the system. If a user is searching for a moved page, the system takes him directly to the moved page in order to ease the procedure for the user and also provide the user with access to any page in the system. Commenting and editing are two functions allowed in this component. Editing will improve the evolution of the project and will assist the research itself in being enhanced and evolved. Commenting will help researchers in brainstorming and also help users emphasize, promote, and ask about particular information in the articles. Avoiding spam comments is always a challenge to designers. In this system, the spam comments are avoided by permissions, delay, and controlling the users. In order to avoid spam comments and also to prevent information from leaking, only permissioned users have the ability to comment on an article. Authors of the articles are able to delay the comment until they review it and have it published. Also, they have the ability to delete it if they find a spam comment. In addition, administration of the system has control over system users and he/she can delete or block a user if he/she has posted too many spam comments. This component supports several wiki formats such as Mediawiki, Tikiwiki, Dokuwiki, creole, and Bbcode. It has a functionality called “revision” to show all the changes to articles and the users who made the changes. This functionality is useful to editors who can trace the history of a project and know where they can contribute. The revisions are stored in the system and the author of the article can revert to a revision or delete a revision if it was

not helpful to his/her research. Another functionality called “diff” shows exactly where the change is located. By clicking on the button "Show diff" in Figure 4, the system will open the page in Figure 5 to show the exact changes. For example, if a user has changed a sentence in an article, the revision shows that a particular user has changed something in the article. But the “diff” shows the previous sentence and the new sentence. Therefore, “diff” is used to compare different revisions and locate the exact change in the revisions. Then, the author is able to make an informed decision when choosing a desired revision.

## article



The image shows a screenshot of a Wiki page. At the top, the word "article" is displayed in a large, dark font. Below it, there is a horizontal navigation bar with four buttons: "View" (highlighted in dark grey), "Edit", "Revisions", and "Track". Below the navigation bar, there is a paragraph of text defining "Seminar". At the bottom of the visible content, there is a button labeled "Add new comment".

**View** Edit Revisions Track

**Seminar** is, generally, a form of academic instruction, either at an academic institution or offered by a commercial or professional organization. It has the function of bringing together small groups for recurring meetings, focusing each time on some particular subject, in which everyone present is requested to actively participate. This is often accomplished through an ongoing Socratic dialogue[1] with a seminar leader or instructor, or through a more formal presentation of research. Normally, participants must not be beginners in the field under discussion (at US and Canadian universities, seminar classes are generally reserved for upper-class students, although at UK and Australian universities seminars are often used for all years). The idea behind the seminar system is to familiarize students more extensively with the methodology of their chosen subject and also to allow them to interact with examples of the practical problems that always occur during research work. It is essentially a place where assigned readings are discussed, questions can be raised and debates can be conducted.[2] It is relatively informal, at least compared to the lecture system of academic instruction.

Add new comment

**Figure 3.** Posting A Wiki Page



## Revisions for *article*

The revisions let you track differences between multiple versions of a post.

View	Edit	Revisions	Track	
Revision	Show diff		Operations	
03/15/2012 - 03:24 by aziz	<input type="radio"/>	<input checked="" type="radio"/>	<i>current revision</i>	
03/15/2012 - 03:09 by aziz	<input checked="" type="radio"/>	<input type="radio"/>	revert	delete
03/12/2012 - 07:52 by aziz	<input type="radio"/>	<input type="radio"/>	revert	delete
03/12/2012 - 07:03 by aziz	<input type="radio"/>	<input type="radio"/>	revert	delete
03/12/2012 - 07:03 by aziz	<input type="radio"/>	<input type="radio"/>	revert	delete
01/18/2012 - 04:05 by aziz	<input type="radio"/>	<input type="radio"/>	revert	delete
01/18/2012 - 03:44 by aziz	<input type="radio"/>	<input type="radio"/>	revert	delete

**Figure 4.** Viewing Revisions

## Revisions for *article*

Comparing two revisions:

View	Edit	Revisions	Track
Thu, 03/15/2012 – 03:09 by aziz		Thu, 03/15/2012 – 03:24 by aziz	
< previous diff			
<b>Changes to <i>Title</i></b>			
-	Write	+	article
<b>Current revision:</b>			

### article

**Seminar** is, generally, a form of academic instruction, either at an academic institution or offered by a commercial or professional organization. It has the function of bringing together small groups for recurring meetings, focusing each time on some particular subject, in which everyone present is requested to actively participate. This is often accomplished through an ongoing Socratic dialogue[1] with a seminar leader or instructor, or through a more formal presentation of research. Normally, participants must not be beginners in the field under discussion (at US and Canadian universities, seminar classes are generally reserved for upper-class students, although at UK and Australian universities seminars are often used for all years). The idea behind the seminar system is to familiarize students more extensively with the methodology of their chosen subject and also to allow them to interact with examples of the practical problems that always occur during research work. It is essentially a place where assigned readings are discussed, questions can be raised and debates can be conducted.[2] It is relatively informal, at least compared to the lecture system of

**Figure 5.** Showing “Diff”

### 5.4.2 Search Engines

Three major functions, located within this component are the Google custom search engine, searching across the system, and refining searches. The first function focuses on finding useful information for users via several websites. The reason to choose the custom search engine is to have the ability to choose particular websites such as scientific websites in order to maintain scientific results. The second function deals with

searching across the system which is helpful in allowing users become familiar with articles in the system. Via this function, users can find, edit or comment on articles. Also, it gives users the ability to choose and write about new topics. In brief, it gives an overview so users know what is going on in the system. The third function is refining searches so as to enhance user queries in order to achieve more determined results. Also, by refining the searches, users can acquire the results very quickly. The users write the query to be searched and then he/she clicks on the label name in order to receive the enhanced results. The label name will consist of more determined websites and usually these websites cover similar subjects.

**Control panel - Refinements: Wiki System's Search Engine**

Refinements are labels that enable you to categorize search results so that users can get to the information they need more quickly. Refinement labels appear as links or tabs at the top of your search results pages. [Learn more.](#)

**Manage refinements**

**Add Refinement**

*You have not added any refinements.*

**Displayed refinements**

Set the max number of refinement labels that you want to show at the top of the search results. [Learn more.](#)

Max number of top refinements to show on search result page: **All**

**Save Changes** **Cancel**

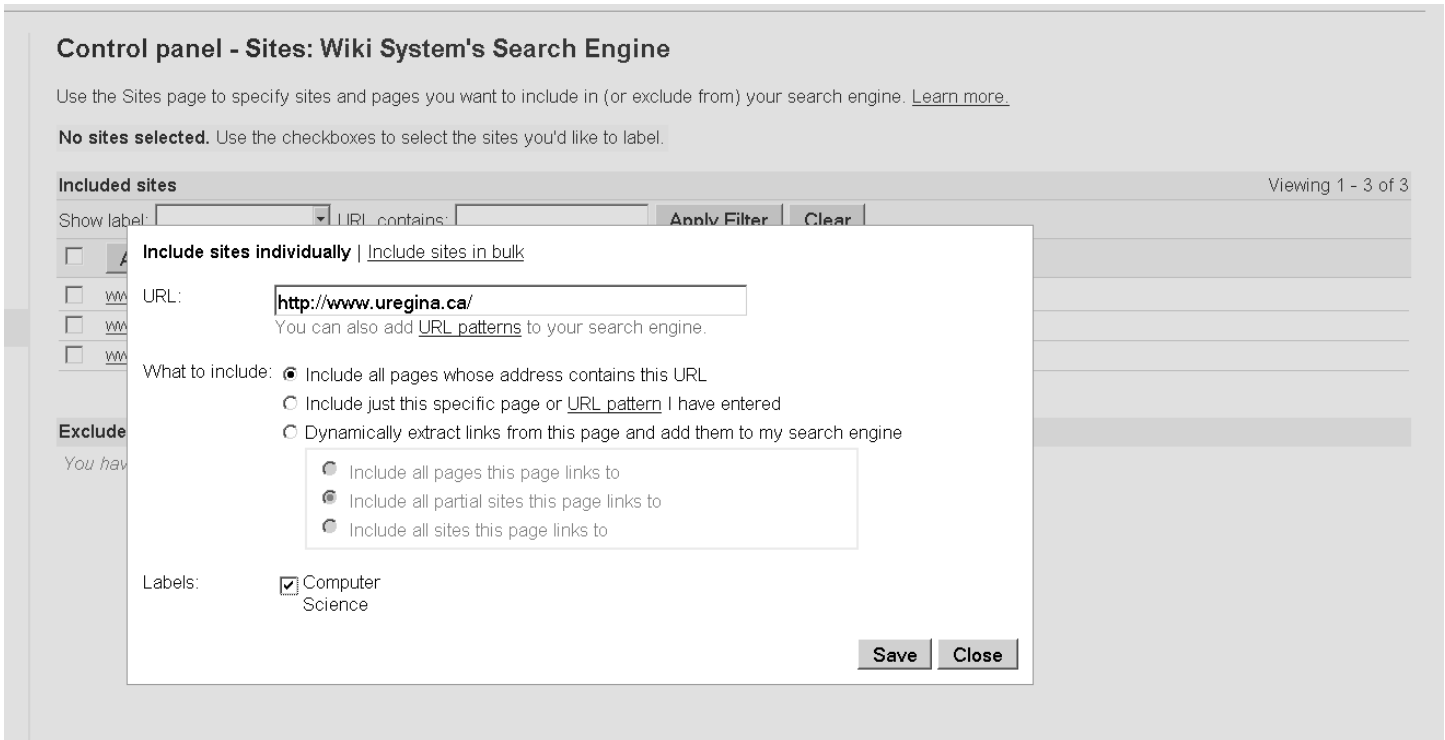
Refinement name: **Computer Science**  
e.g. Lectures

How to search labeled sites:  
 Give priority to selected sites.  
 Search only selected sites.

Word(s) to add to the search query: (optional)  
e.g. lectures OR talks  
You can use [advanced search operators.](#)

**Save** **Close**

**Figure 6.** Choosing Refinement Name [3].



**Figure 7.** Adding URLs under the Label Name [3]

### 5.4.3 Web Page Analyzing

In this component, Google analytics is used to track system users and events created by the users. The functions will give the users an overview of what is happening in the system. By tracking the users of the system, this component shows the visited page or article and the user who visited the page. Also, it shows the exact time the user visited the page or article. So, user interests will be known and other authors may benefit from this information and focus on the interested topics. Furthermore, showing the time when the user has visited the page is helpful and increases the accuracy in this function. In addition, by tracking the events, this component shows the latest activities in the system in order to keep the comments on track. So, users can be up-to-date with regard to new

articles and posts and renewal of the system will be guaranteed. Moreover, tracking events is useful to discover which article received the most collaboration from users of the system. It shows the event, the exact time when the event took place, and details regarding the event. In tracking users, showing the exact time will improve the accuracy of tracking results.

[Log out](#)

---

**Author Information**

abdul

Online

Last seen: 10 min 14 sec ago

Joined: 03/15/2012

## abdul

View
Edit
Track page visits

Timestamp ▾	Page	Operations
03/15/2012 - 06:11	Create content node/add	details
03/15/2012 - 06:10	node	details
03/15/2012 - 06:10	Search node/4	details
03/15/2012 - 06:10	Home Page node/2	details
03/15/2012 - 06:10	article node/3	details
03/15/2012 - 06:10	User account user	details
03/15/2012 - 06:10	abdul user/2	details
03/15/2012 - 06:06	Home Page node/2	details
03/15/2012 - 06:06	article node/3	details
03/15/2012 - 06:06	Search node/4	details
03/15/2012 - 06:06	User account user	details

**Figure 8.** Tracking a User

## Recent hits

This page displays the site's most recent hits.

Timestamp▼	Page	User	Operations
03/15/2012 - 04:43	Available updates admin/reports/updates	aziz	details
03/15/2012 - 04:43	Refresh Appbar appbar/refresh/count	aziz	details
03/15/2012 - 04:43	Available updates admin/reports/updates	aziz	details
03/15/2012 - 04:42	Top visitors in the past 3 days admin/reports/visitors	aziz	details
03/15/2012 - 04:42	Access log settings admin/reports/settings	aziz	details
03/15/2012 - 04:42	Access log settings admin/reports/settings	aziz	details

**Figure 9.** Recent Hits

### 5.4.4 Search Engine Referrers

In this component, two major functions are taking place which follow the search engine queries and the URLs. The first function can show the most used phrases by users in order to know their interests. So, the researcher may see the top search phrases and become aware of the most popular user topics and that will give the researchers ideas regarding their future projects. It displays the messages, which are the phrases, and how many times they are used as keywords in the search engines. The second function which

follows the URLs, deals with parsing the referrer URLs of the search engines in order to extract search queries. It follows the hyperlinks to know the referrer URLs of the search engines to find the keywords and user queries.

## Top search phrases

Count▼	Message
10	<i>information science</i> (Content).
10	<i>web-based</i> (Content).
9	<i>electronic commerce</i> (Content).
9	<i>WRSS</i> (Content).
7	<i>wiki</i> (Content).
7	<i>computer science</i> (Content).
7	<i>information retrieval</i> (Content).
7	<i>data mining</i> (Content).
7	<i>web-based</i> (Google).

**Figure 10.** Top Phrases

### 5.4.5 Forum

This system provides a forum component to give system users the ability to share their knowledge and discuss the contents of articles in order to improve article information and enhance the presentation of knowledge. It has several functionalities such as showing the most recent topics, presenting statistics, and providing containers. In the first functionality, the component displays the titles of the most recent topics in order

to enable users to track the most recent topics. So, interaction between users will increase and will be updated constantly. In the second functionality, statistics such as the number of topics, posts, and users are investigated. Statistics are helpful in providing the forum administrator with knowledge as to how the forum is operating. In the third functionality, creating containers is allowed in order to contain different forums which have similar topics. For example, the user can create a container for computer science which includes forums for computer science topics which is useful when managing forums and organizing them in order to present organized forums to users.

## new topic

<b>View</b> Edit Track	
aziz	Posted: Mon, 03/12/2012 - 11:16
	new topic
Add new comment	

**Figure 11.** New Forum Topic



## new topic

View	Edit	Track	
Time▼	Referrer	User	Operations
03/15/2012 - 06:14	http://localhost:57006/forum/1	aziz	details
03/15/2012 - 06:13	http://localhost:57006/node/6	aziz	details
03/15/2012 - 06:13	http://localhost:57006/forum/1	aziz	details

**Figure 12.** Tracking New Topic

### 5.5 Implementation

This system consists of four layers, namely the client layer, the business layer, the web server layer, and the database layer. In order to test the main functions of the system and to understand their functionalities, I have implemented a prototype of the system on a single machine. That means all the layers are grouped in a single machine.

First, I have implemented the client layer which contains sign up and sign in pages to allow users to access to the system. Users can access through a user interface to the business layer. The business layer contains the main components of the system which are the wiki pages, search engines, web page analyzing, search engine referrers, and forum. In coming section I will present the main functions that have been implemented in every component.

In the Wiki Pages' component, I have implemented the function of creating wiki page to allow researchers to create wiki pages in order to express their ideas and to publish their researches. I have implemented the editing function in the wiki pages' component which includes the revision's functionalities such as reverting to a revision, deleting a revision, and showing diff. I have implemented the commenting functionality with giving the ability to authors to delete spam comments and allowing only users who have permissions to comment in order to avoid spam comments and also to prevent information from leaking. In addition, administration of the system has control over system users and he/she can delete or block a user if he/she has posted too many spam comments.

In the Search Engines' component, I have embedded Google custom search engine which allows the users to search across the web through a list of websites that I can choose, to search across the system, and to refine the searches.

In the Web Page Analyzing component, I have embedded Google analytics to track system users and events created by the users. This component shows the visited page or article and the user who visited the page. Also, it shows the exact time the user visited the page or article. It also shows the latest activities in the system, the exact time when the event took place, and details regarding the event.

In the Search Engine Referrers' component, I have implemented following the search engine queries to show the most used phrases by users and how many times they are used as keywords in the search engines.

In the Forum's component, I have implemented creating, editing, and deleting forum topic. I also have implemented showing the most recent topics and providing containers. Tracking new topic is implemented to show the user who created or edited the topic, the exact time when the event took place, and details regarding the event.

Finally, all the data will be stored in the storage layer through the web server in order to extract it again when it is needed. Then, if a user queried data from the database which is located in the web server, the system will display this data to him/her.

## **5.6 Conclusion**

Researchers face many obstacles when they use online resources and thus, a web-based system is needed. On another hand, wiki technology has several qualities which may affect the efficiency of researches and communication between researchers. A wiki system to support research activities would delete obstacles in the path of researchers' and give researchers the advantage of wiki technology. In this chapter, a wiki system to support researchers and the research process has been discussed via two major components, i.e. wiki pages and supporting components to the wiki pages which include the search engine, web page analyzing, search engine referrers, and forums. Wiki page components have many functions such as creating wiki pages, commenting and editing, and providing some tracks. The search engine consists of several functions such as the Google custom search engine, searching across the system, and refining the searches. The web page analyzing component includes Google analytics which provides tracking to users to find and record visited pages and track events to be aware of the latest activities

in the system. The search engine referrers includes functionalities such as viewing search engine queries to learn the top phrases and parsing the URLs to extract search queries. The forum component in the system includes functions such as displaying the most recent topics, showing statistics, and creating containers.

## 6. Software Documentation of the System

### 6.1 Introduction

The reason behind developing this system is to facilitate the use of information resources in order to help users who have difficulties. The user of the system is able to log into the system and search the web to find valuable information about his/her idea. Also, the user can create wiki pages to write down his/her project in order to allow other users to enhance it. The user can create a forum topic to discuss ideas with respect to the project with other users. Finally, the user can view statistics regarding the projects, forum topics, and users of the system.

### 6.2 Use cases

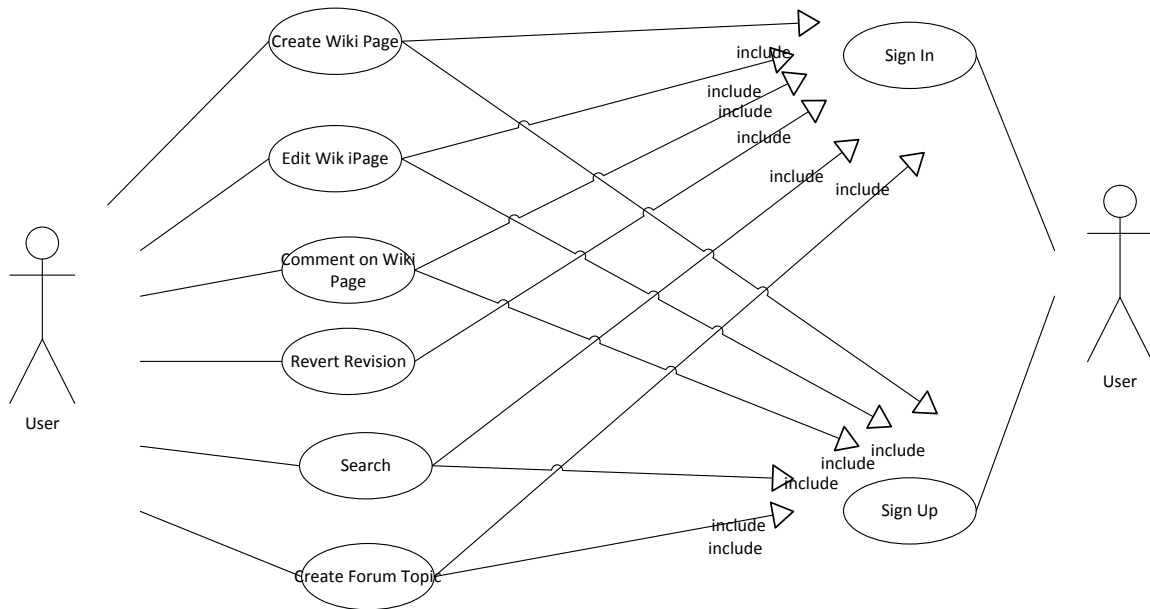


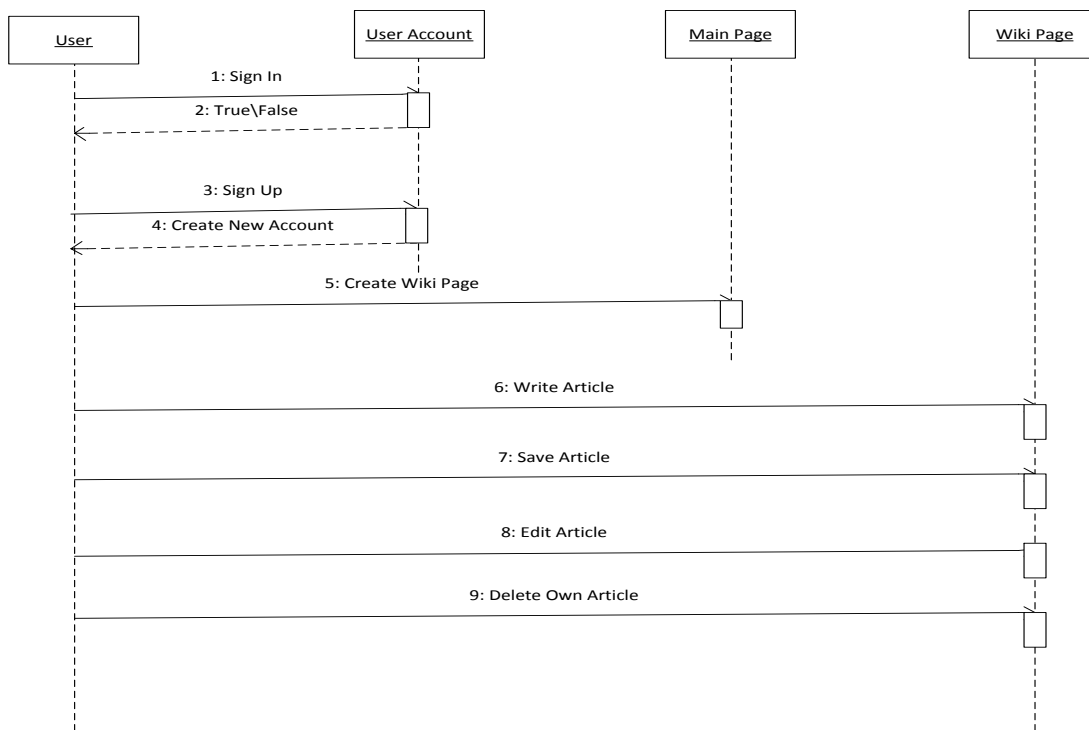
Figure 13. Several Use Cases

Figure 13 shows some user cases and examples of use of the system by users.

- The user should sign up to create a new account.
- The user should sign in if he/she has an established account.
- The user creates a wiki page.
- The user edits their wiki page.
- The user comments on a particular article.
- The user reverts to particular revisions which are the changes in the article.
- User searches on the web and across the system.
- The user creates a forum topic.

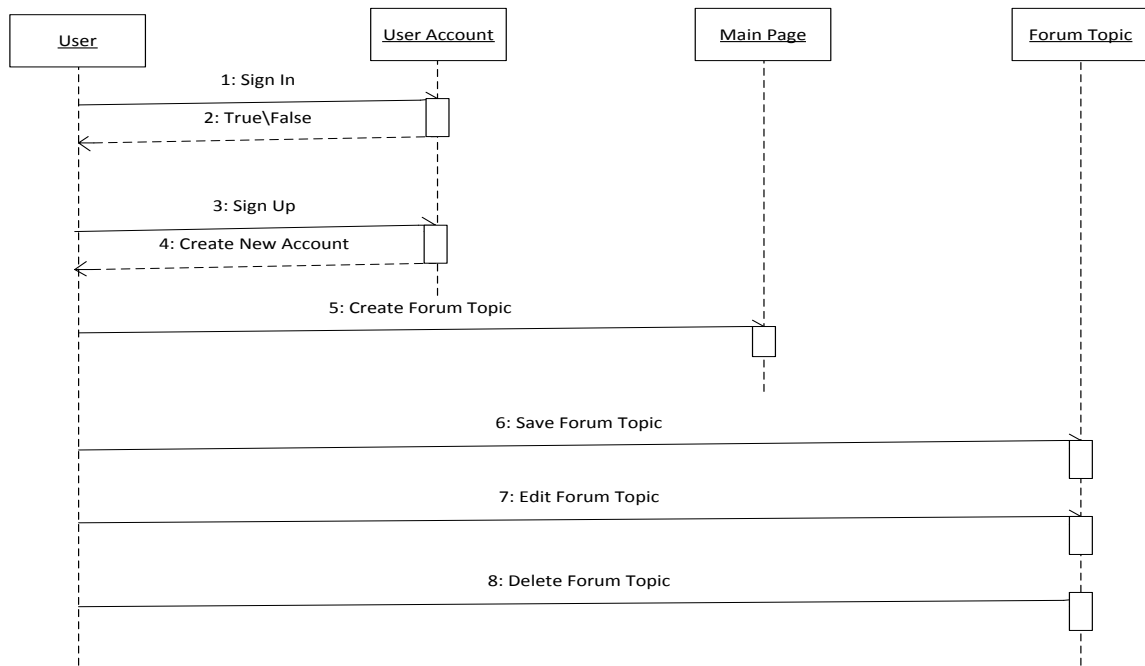
### **6.3. Sequences Diagram**

Figure 14 is a sequence diagram for wiki pages in the system. It shows the user can log into the system if he/she has an account. If he/she does not have an account, he/she should create a new account. After that, the user can go back to login from the main page. At this point the user can create a wiki page and write the article in the body of the page. The user can save the new wiki page. After that, the user can go back and edit the same article or delete the wiki page.



**Figure 14.** Wiki Page Sequence Diagram

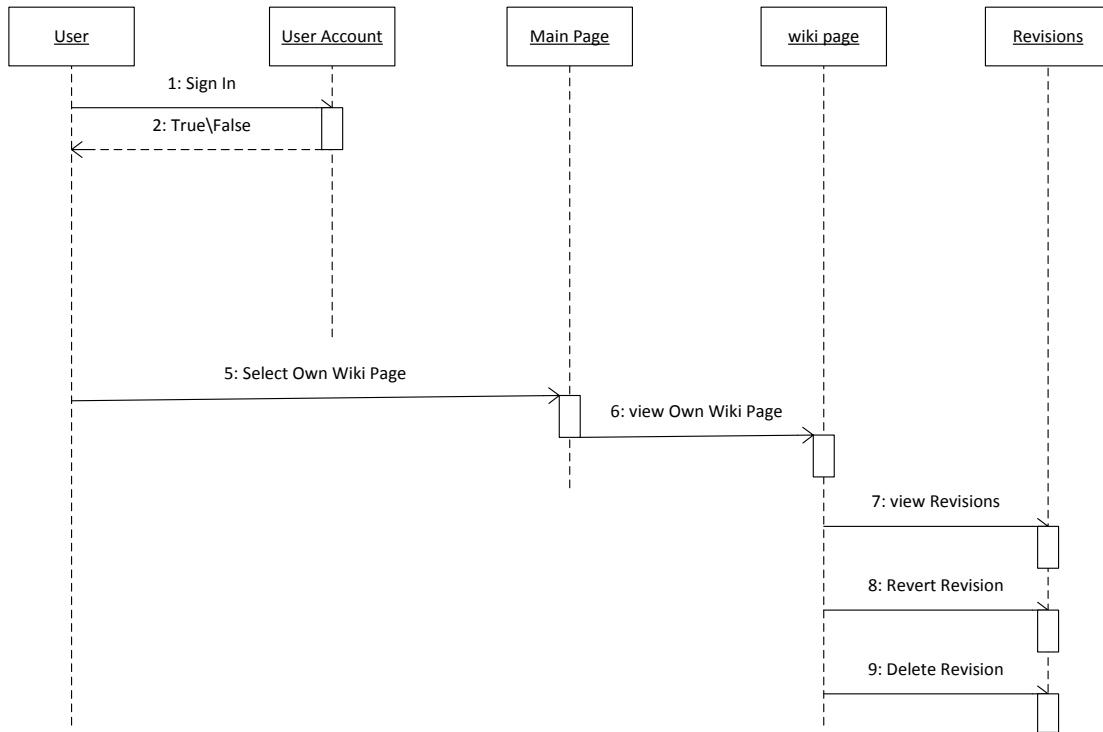
Figure 15 is a sequence diagram for forum topic in the system. It shows the user can log into the system if he/she has an account. If he/she does not have an account, he/she should create a new account. After that, the user can go back to login from the main page. The user can create a forum topic and post it in the body of the forum page. The user can save the new forum topic at this point or go back and edit the forum topic. The user can delete the forum topic as well.



**Figure 15.** Forum Topic Sequence Diagram

Figure 16 is a sequence diagram for revisions in the system. It shows the user can log into the system. After that, the user can go to view his/her wiki page and any revisions that are stored in the revisions' page. The user can revert to a particular revision or delete a revision if he/she found it useless.

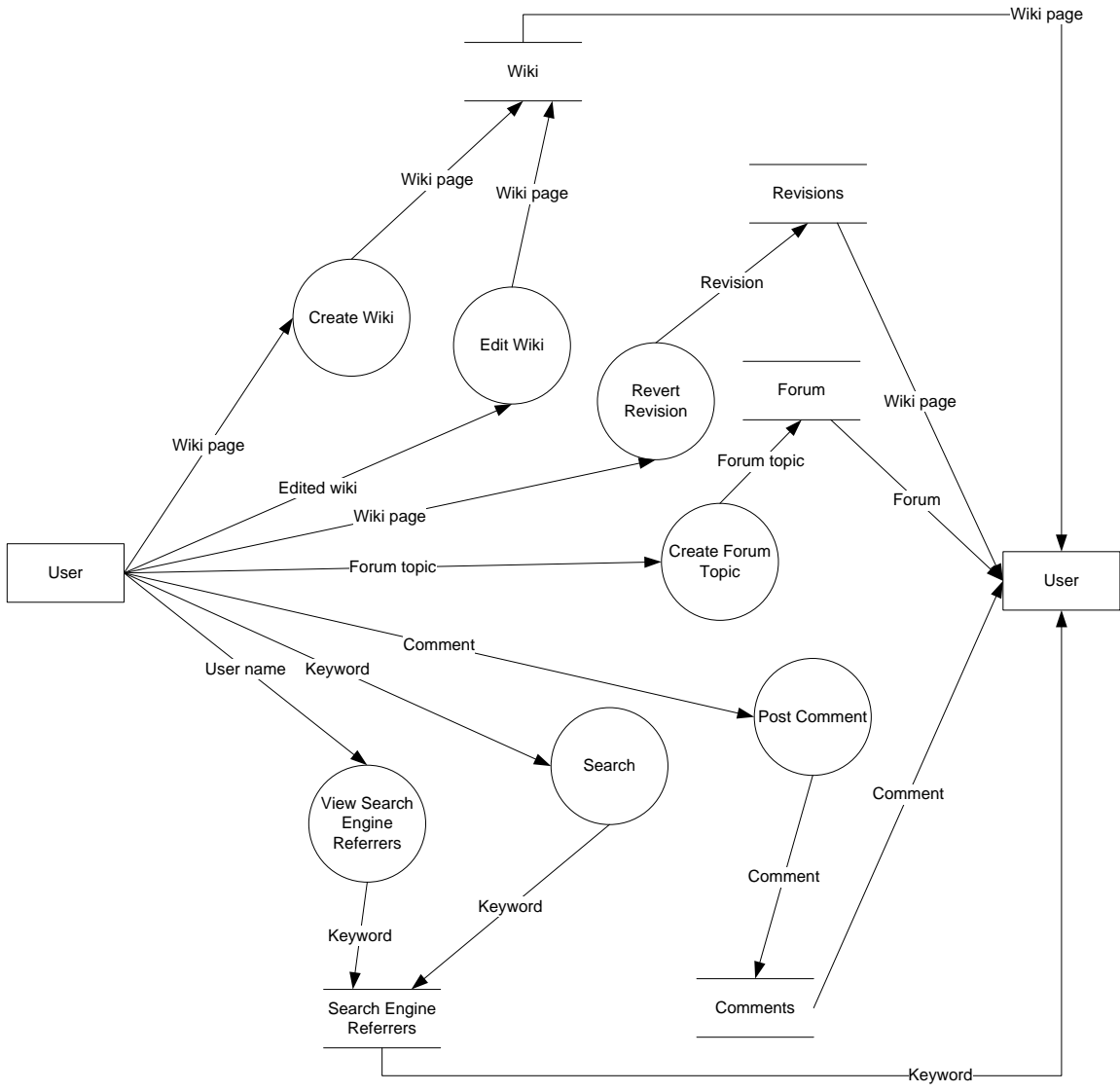




**Figure 16.** Revisions Sequence Diagram

#### 6.4 Data Flow Diagram (DFD)

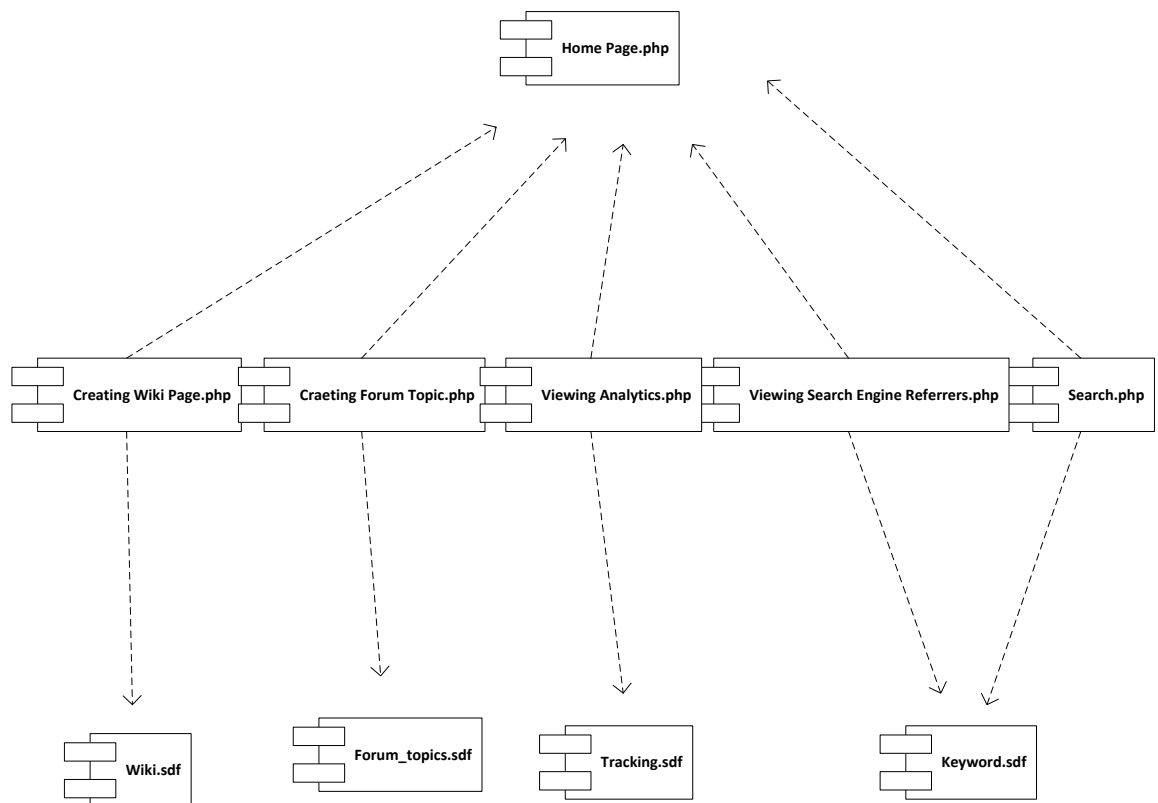
Figure 17 represents the data flow diagram of the system and how the data flows between the components of the system. The rectangular boxes which are opened from two sides show where the data is stored. The circles show the actions which are happened inside the system. The full rectangular boxes show the external entities. The arrows show the flow of data among the databases and the actions.



**Figure 17.** Data Flow Diagram

## 6.5 Component Diagram

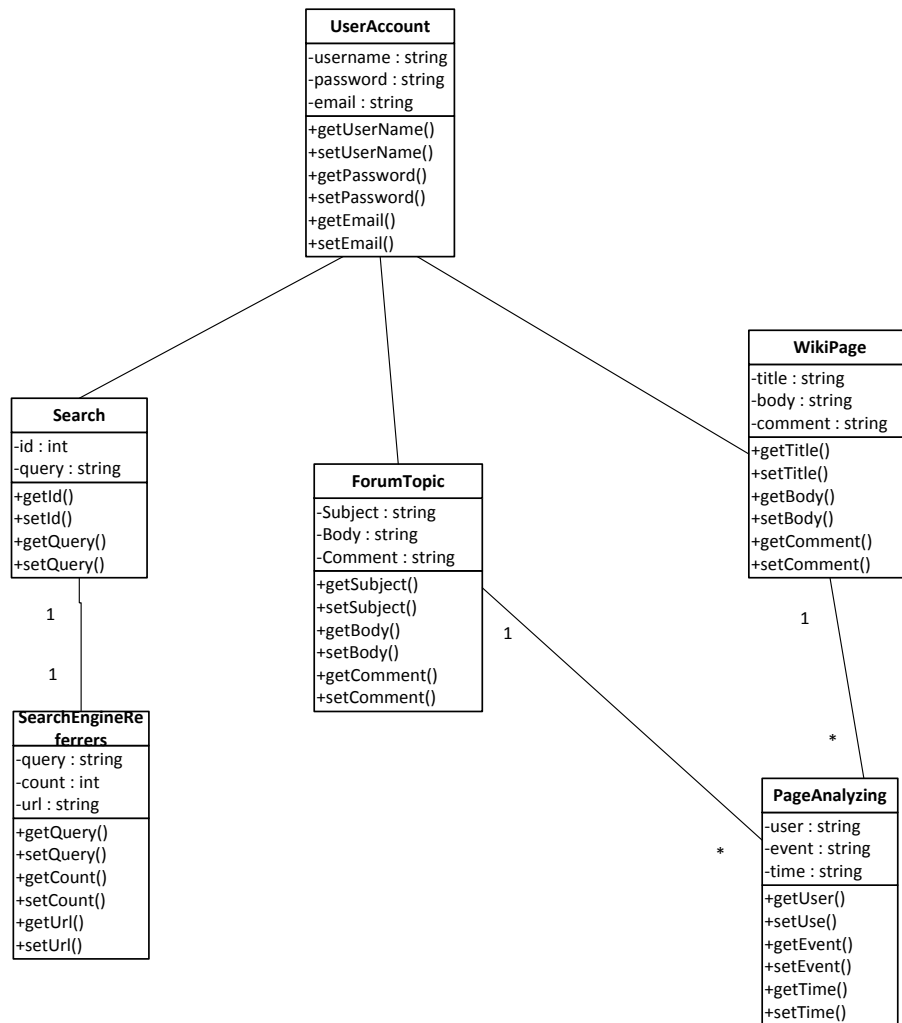
Figure 18 represents a component diagram of the system. It shows six components within the system which are the home page, creating wiki page, creating forum topic, viewing analytics, viewing search engine referrers and search. Also, it shows database's components which are wiki, forum topics, tracking, and keyword.



**Figure 18.** Component Diagram

## 6.6 Class Diagram

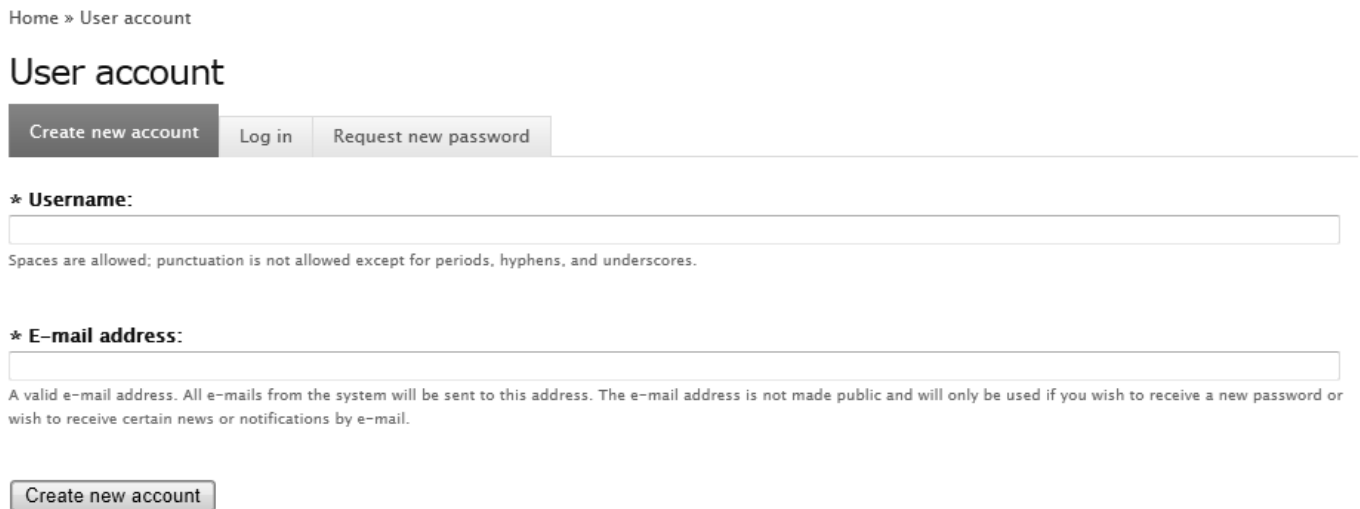
Figure 19 represents a class diagram of the system. It shows the classes of the system and the relationships between them. The classes are UserAccount, WikiPage, ForumTopic, Search, PageAnalyzing, and SearchEngineReferrers.



**Figure 19.** Class Diagram

## 6.7 Screenshots of the System

Figure 20 shows how to create a new account in the system. The user just needs to write an appropriate and unique username and email address. The system sends the password to that email address. Then, the user can log into the system via their new password and username. If the user writes a username or email address that already exists, the system will display a message to inform him/her.



Home » User account

### User account

Create new account Log in Request new password

\* Username:

Spaces are allowed; punctuation is not allowed except for periods, hyphens, and underscores.

\* E-mail address:

A valid e-mail address. All e-mails from the system will be sent to this address. The e-mail address is not made public and will only be used if you wish to receive a new password or wish to receive certain news or notifications by e-mail.

Create new account

**Figure 20.** Create a New Account

Figure 21 displays a log in page and how the user can write their unique user name and the password which he/she received via their email address. If any of the usernames or passwords is incorrect, the system will exhibit a message to say either the username or the password is unrecognized.

Home

✕ Sorry, unrecognized username or password. Have you forgotten your password?

## User account

[Create new account](#) [Log in](#) [Request new password](#)

**\* Username:**  
  
Enter your myproject username.

**\* Password:**  
  
Enter the password that accompanies your username.

[Log in](#)

**Figure 21.** Wrong Username or Password

Figure 22 shows how the user can request a new password by inserting his/her correct username or email address and then clicking the "e-mail new password" button to receive an email containing the new password.

Home » User account

## User account

[Create new account](#) [Log in](#) [Request new password](#)

**\* Username or e-mail address:**

[E-mail new password](#)

**Figure 22.** Requesting a New Password

Figure 23 shows the creating of a profile for new users which directly follows the creation of a new account or it could occur later if the user so wishes. To create a profile, the user must fill in the blanks in the categories of the profile such as account, about me, basic information, contact information, education, research area, and work.

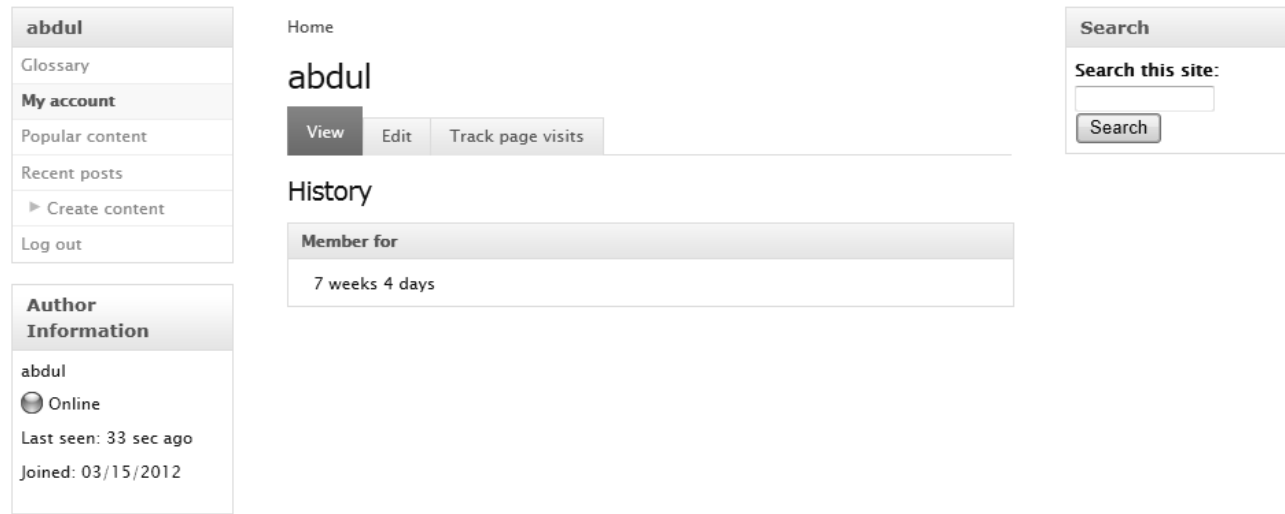
The screenshot shows a user profile page for 'abdul'. The page has a breadcrumb trail 'Home » My account'. The user's name 'abdul' is displayed prominently. Below the name are three buttons: 'View', 'Edit', and 'Track page visits'. A dark navigation bar contains several menu items: 'Account', 'About me', 'Basic Information', 'Contact Information', 'Education', 'Research Area', and 'Work'. The 'Account' menu item is currently selected. On the left side, there is a sidebar with the user's name 'abdul' and a list of links: 'Glossary', 'My account', 'Popular content', 'Recent posts', 'Create content', and 'Log out'. On the right side, there is a search box with the text 'Search this site:' and a 'Search' button. The main content area is titled 'Account information' and contains the following fields:

- \* E-mail address:** A text input field containing 'abdj99@yahoo.com'. Below it is a note: 'A valid e-mail address. All e-mails from the system will be sent to this address. The e-mail address is not made public and will only be used if you wish to receive a new password or wish to receive certain news or notifications by e-mail.'
- Password:** An empty text input field.
- Confirm password:** An empty text input field.

At the bottom of the form, there is a note: 'To change the current user password, enter the new password in both fields.'

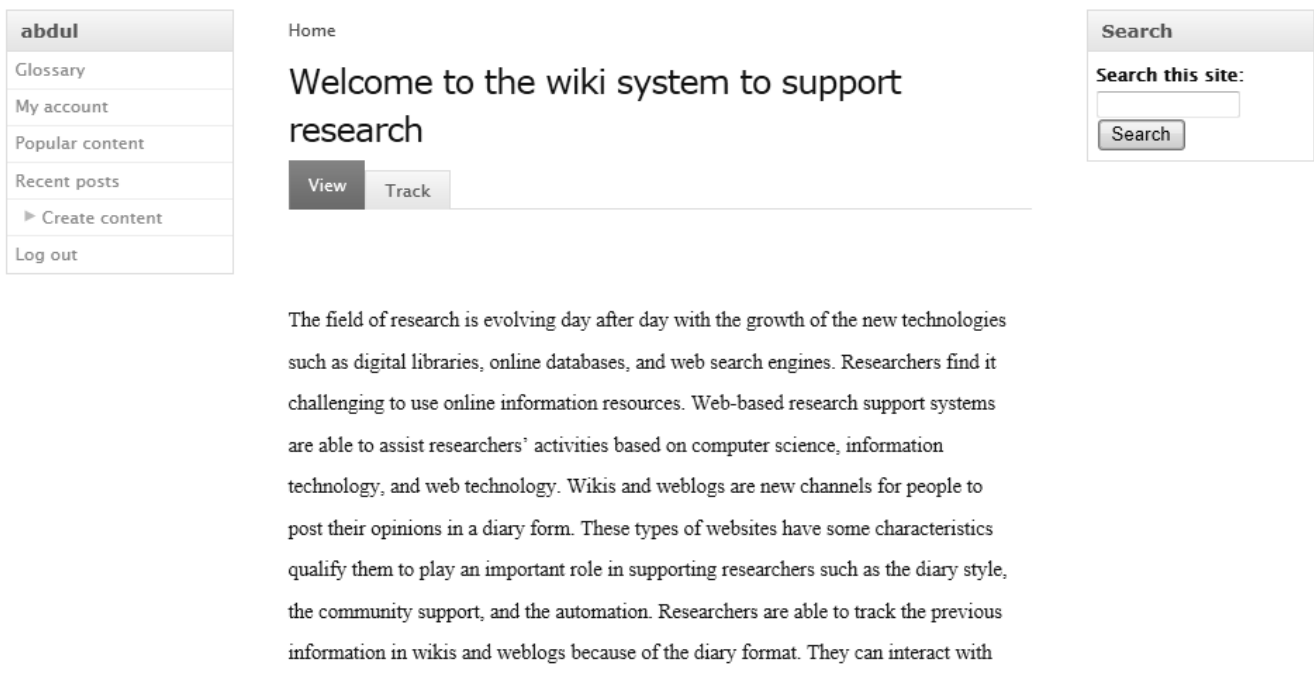
**Figure 23.** Creating a Profile

Figure 24 shows the name of the user, the history of the user, and the pages visited by the user. Also, by clicking “edit”, the user can edit his/her account information.



**Figure 24.** Viewing the User's Account

Figure 25 displays the front page of the system and by clicking the track button; users who visited this page can be shown.



**Figure 25.** The Front Page



Figure 26 displays the visited pages by the user and the exact time and date of the visit. Also, it shows some details regarding the visit if the user clicks on the details button.

Home » My account

**abdul**

View Edit **Track page visits**

Timestamp	Page	Operations
05/07/2012 - 04:11	abdul user/2/edit	details
05/07/2012 - 04:11	abdul user/2/edit/Basic Information	details
05/07/2012 - 04:11	abdul user/2/edit	details
05/07/2012 - 04:10	abdul user/2	details
05/07/2012 - 04:10	abdul user/2/edit	details
05/07/2012 - 04:10	abdul user/2	details

**Author Information**

abdul  
 Online  
 Last seen: 1 min 50 sec ago  
 Joined: 03/15/2012

**Search**

Search this site:  
  
 Search

**Figure 26.** Visited Pages by the User

Figure 27 shows the organization of the pages in the system, which are categorized by the first letter. The title of the page, the author, and the last update are shown in the organization page which is called the “Glossary”.

Home

A (1) | H (3) | N (1) | P (1) | S (1) | T (1) | W (3)

Title	Author	Last update
article	aziz	Thursday, March 15, 2012 - 04:19

**abdul**

**Glossary**

My account  
 Popular content  
 Recent posts  
 Create content  
 Log out

**Search**

Search this site:  
  
 Search

**Figure 27.** Organization of the Pages in the System

Figures 28 & 29 display the popular pages in the system and the authors of those pages. The figures show the popular pages in general and also the popular pages today. Figure 29 shows the number of views in the “today” popular pages as well.

Home

## Popular content

Popular content Today's popular content

Type	Title	Author
Page	Home Page	aziz
Wiki page	article	aziz
Page	Search	aziz
Wiki page	hhkxkxhlgkglh	aljuaid
Page	Welcome to the wiki system to support research	aziz
Forum topic	new topic	aziz
Forum topic	hello	abdul
Wiki page	wiki pagenew	aziz
Wiki page	Presentation	abdul

**Figure 28.** Popular Contents in the System

Home » Popular content

## Popular content

Popular content Today's popular content

Type	Title	Author	Views today
Page	Home Page	aziz	29
Wiki page	article	aziz	28
Page	Search	aziz	19
Wiki page	hhkxkxhlgkglh	aljuaid	11
Page	Welcome to the wiki system to support research	aziz	10
Forum topic	new topic	aziz	9
Forum topic	hello	abdul	4
Wiki page	Presentation	abdul	3
Wiki page	wiki pagenew	aziz	3

**Figure 29.** Popular Contents in the System Today

Figure 30 shows the latest posts in the system, the author, the number of replies, and the exact time and date. The recent posts button is located in the permanent bar at the left of the page.

The screenshot shows a web interface with a user profile on the left, a search bar on the right, and a central 'Recent posts' table. The table contains the following data:

Type	Title	Author	Replies	Last Post
Forum topic	hello	abdul		05/06/2012 - 22:54
Wiki page	wiki page new	aziz		04/28/2012 - 04:29
Wiki page	article	aziz	1	04/28/2012 - 04:24
Wiki page	hhkhhkhlgkgkglh	aljuaied		04/28/2012 - 04:18
Page	Home Page	aziz	1	04/27/2012 - 20:36
Wiki page	Presentation	abdul		03/15/2012 - 04:28
Wiki page	wiki	aziz		03/12/2012 - 22:45
Forum topic	new topic	aziz		03/12/2012 - 11:16
Page	test	aziz		03/12/2012 - 08:24
Page	Search	aziz		01/18/2012 - 04:05
Page	Welcome to the wiki system to	aziz		09/09/2011 - 15:15

**Figure 30.** Recent Posts

## 6.8 Technical Documentation

- a) Programming Languages.
  - Php language.
- b) Tools and environments.
  - Microsoft Web Matrix.

- Php Language.
  - Microsoft SQL Server Compact.
- c) Database system.
- Microsoft SQL Server Compact.

## **6.9 Conclusion**

A wiki system to support researchers has been designed and the diagrams to explain the system have been described with documentation of the system such as the Use Cases, Sequences Diagram, Data Flow Diagram, Component Diagram, Class Diagram, and several screenshots of the system.

## **7. Conclusion and Future Work**

### **7.1 Conclusion**

As presented in this project, the main goal of the wiki system is to support researchers and to assist research activities based on the WRSS methodologies and wiki technology's qualities [20, 26]. Hence, this area of the WSS was presented as an introduction in order to understand the WRSS [13, 25]. The WRSS, the research activities, and the research functionalities were described to explain the first approach to building this project [19, 26]. Wiki technology and its characteristics were presented in order to understand the second part of building the system [20, 21]. Finally, a prototype of the wiki system to support researchers was introduced along with its main components and several supporting software diagrams to explain the prototype. In conclusion, this project is an application of the web intelligence's field and several methodologies of the WRSS were applied. Furthermore, it meets the requirements of individual researchers conducting scientific research.

### **7.2 Future Work**

Future work intended to enhance the wiki system in order to support researchers:

1. Inserting new approaches to extract data.
2. Applying wiki technology to retrieve data from digital libraries.
3. Using semantic wiki search.
4. Exploring data via visual methods.

5. Integrating the Web Information Retrieval Support System with this system.
6. Dealing with further content types than wiki pages.
7. Embedding online dictionaries to support different languages.
8. Building the full system which runs on external web servers.

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