

WEB SITE EVALUATION

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# **ABSTRACT**

## **WEB SITE EVALUATION**

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This thesis focuses on web site evaluation by using structural evaluation and scope of business based content comparison. Firstly, web site measurement techniques and evaluation methods are reviewed. Then a structural evaluation and content comparison method introduced. This thesis also includes a web based implementation of these methods for evaluating web sites which is partially automated for structural evaluation method.

**Keywords:** Web site evaluation, Web site measurement, structural evaluation, content comparison, automated evaluation.

# ÖZ

## WEB SİTESİ DEĞERLENDİRME

GENÇ, Ahmet Şakir

Yüksek Lisans, Bilişim Sistemleri Bölümü

Tez Yöneticisi: Dr. Ali ARİFOĞLU

Eylül 2006, 76 sayfa

Bu tez yapısal değerlendirme ve faaliyet alanı tabanlı içerik karşılaştırma kullanılarak web sitesi değerlendirmeyi konu alır. Başlangıçta web sitesi ölçümü teknikleri ve değerlendirme yöntemlerini incelenmiştir. Ayrıca bir yapısal değerlendirme ve içerik karşılaştırma yöntemi sunulmaktadır. Bu tez aynı zamanda yapısal değerlendirmenin kısmi olarak otomatikleştirildiği web sitesi değerlendirme uygulamasını da içerir.

Anahtar Kelimeler: Web sitesi değerlendirme, Web sitesi ölçümü, yapısal değerlendirme, içerik karşılaştırma, otomatikleştirilmiş değerlendirme.

To my wife Yeliz and my daughters Serenay, Simay and Defne

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## **LIST OF ABBREVIATIONS AND ACRONYMS**

ER	: Entity - Relationship
HTTP	: Hypertext Transfer Protocol
IP	: Internet Protocol
LPC	: Link Popularity Check
SAWSET	: Semi Automated Web Site Evaluation Tool
TCP/IP	: Transmission Control Protocol/ Internet Protocol
URL	: Universal Resource Locator
UE	: Usability Engineer
UML	: Unified Modeling Language
W3C	: World Wide Web Consortium
WCAG	: Web Content Accessibility Guidelines
WAMMI	: Web Analysis and Measurement Inventory

# **CHAPTER 1**

## **INTRODUCTION**

### ***1.1 Motivation and Problem Statement***

Web is becoming more and more important each day for conducting business, sharing information and for communication. Every passing day the number of companies, organizations and individuals publishing their web sites is increasing [18]. Considering all the information available on the web every individual should desire to find and access useful information. For example companies want to learn what their competitors do and what products they offer using the web. By the help of this information companies may learn from their rivals and improve their own web sites to increase their competitiveness.

Considering their web sites, companies or institutions have various methods to attract customers use their web sites to purchase goods or services or make customers take advantage of their web sites. Carrying out this mission necessitates ongoing monitoring and modification of their web sites according to the needs of their customers and to take all measures on every respect which may include competitive inspirations. This means that companies and institutions shall periodically evaluate their web sites on a structural basis and by comparing their rival companies' web sites to maintain their competitiveness.

The task of evaluating and improving the web sites can be intimidating considering the number of web sites available and the frequency of updates. As a result, automated support for web designers and web site owners become more important.

Automated usability tools can help save time and money in design. User testing can improve consistency and quality of the web site [1] .

It is not feasible to specify a checklist to evaluate a web site with constant controls which will ignore even daily changing web site contents. To provide a dynamic evaluation process, evaluation shall be separated into parts those will monitor and evaluate ordinarily stable and frequently changing characteristics.

To provide a solution to the problem this thesis presents an approach to evaluate web sites in two main separate areas, first one is structural evaluation to evaluate ordinarily stable characteristics and the second one is content evaluation which will use a simple method to compare content of the web sites in the same scope of business.

The main objective of this work is to implement a web site evaluation tool covering most important aspects of web site evaluation criteria.

## ***1.2 Thesis Structure***

This text is organized as follows:

Chapter 2 provides related research on web site measurement approaches consisting of questionnaires, behavior observation tools and automatic evaluation tools. Specific automatic evaluation tools are introduced.

Chapter 3 includes our approach for web site evaluation that covers structural evaluation and content comparison in detail.

Chapter 4 explains implementation of this method and partial automation of structural evaluation.

Chapter 5 discusses the justification for this web site measurement method.

Chapter 6 gives a conclusion including recommendations for future work and contribution.

## **CHAPTER 2**

### **RELATED RESEARCH**

This chapter provides related research on web site measurement approaches consisting of questionnaires, behavior observation tools and automatic evaluation tools. Specific automatic evaluation tools are introduced.

#### ***1.3 Current Web Site Measurement Approaches***

There are many criteria to evaluate a web site. Those may include: usability, authority, currency, objectivity, coverage, performance, traffic ranking, link popularity, accessibility, security, design patterns, HTML syntax analysis, and browser compatibility. It is possible to increase the number of criteria by decomposing the titles. The available literature includes various approaches to evaluate a web site. Below explained approaches may be used nested or together to enhance the accuracy of an evaluation process.

User questionnaires are one of the most commonly used means to evaluate a web site [2]. As questionnaires base on evaluation practices they provide an evaluation form the user's point of view depending on evaluation practices. Questionnaires aim to assess user perception using the checklists they compose of.

Behavioral assessment methods are generally used for psychological researches for a long time [3]. The aim of the behavioral assessment methods ate to observe users'



behavior during tests. Test development, psychometrics measurement and data collection which made automatically are important aspects for this method.

Automatic tools examine source code of web pages to determine the compatibility of web pages with specified guidelines. These guidelines may cover universally accepted guidelines or guidelines accepted in a specific society. This approach is new and depends on the characteristics of HTML [7].

### **1.3.1 Questionnaires**

A questionnaire is an indirect evaluation technique for web site evaluation. It must satisfy some requirements such as being clear for evaluation context. It can provide valuable feedback from the users. Therefore questionnaire results shall be carefully examined. As the complexity of a questionnaire increase results may be difficult to analyze to provide required outcomes. Answer format must be well formed to ease the analyzing phase.

A number of guidelines have been formed to explain how to create questionnaires that best fits the needs. Sullivan [4] provides some conditions for increasing the true value of test results. This may be applied for web site evaluation. For example, new users should be included in the group as a lot of people using the web are not experts. Most of the site owners consider anybody as their users regardless of their internet experience. So design of a questionnaire should also consider new users. Anyway there no exact answers for web site users culture experience, age, sex etc. Two different web users may give opposite answers for the same question depending on their own point of view. As evaluation covers subjective aspects this shall be considered ordinary. Therefore questionnaires shall be prepared not only using specified guidelines but also they must cover a subject in a question by

totally providing user a good understanding. The main goal shall be to determine user satisfaction about the web site [5].

WAMMI (Web Analysis and MeasureMent Inventory) [6], developed by the Human Factors Research Group of the University College at Cork, Ireland, is an evaluation tool for web sites, based on customizable questionnaires. These questionnaires are filled by the site visitors. Questions of these questionnaires cover five factors namely: attractiveness, control, efficiency, helpfulness and learnability. Questions are based on single visual and logical characteristics, or on generic satisfaction criteria. This may not be sufficient to analyze web site measurement problems that depend on the users' needs [7].

Questionnaires are also used to provide specific information about a web page. These may include identity, security, etc. in addition to usability measures (attractiveness, control, efficiency, helpfulness, learnability). This kind of a questionnaire is not filled by users but by experts or non experts taking advantage of some automated tools to help them fill these questionnaires.

### **1.3.2 Behavior Observation Tools**

Web site evaluation made using questionnaires may not express user's actual intent. To determine user's actual satisfaction behavioral assessment techniques are used. These techniques depend on psychological considerations of the user. Observer is the most popular behavior observation tool which was produced by Noldus Company [8]. The Observer provides collection, analysis, presentation and management of observational data. It can be used to record activities, postures, movements, positions, facial expressions, social interactions and other aspects of users' behavior.

During an observation session, each key press is logged together with its time of occurrence. Each log entry is time-stamped by the system. Comments and notes can be added during observation session. These are saved with data. After finishing data collection, collected data is analyzed by many functions. Results can be used to assess the interaction of the user and the application..

Behavior observation tools require testing laboratories with complex and expensive devices. This technique also requires comprehensive analysis of collected data. Insufficient consideration of collected data may cause wrong results. However this technique is expensive and complex it provides integrated data which is not gained using other techniques [7].

### **1.3.3 Automatic Evaluation Tools**

Automatic web site evaluation tools provides software support by analyzing HTML codes of a web site or by using other methods such as toolbars that follows user web access behaviors. Automatic evaluation tools may capture and record usage data or perform an analysis to identify potential usability problems depending on specific guidelines. All detected problems may not be actual problems. More complicated tools may provide suggestions to improve the web sites quality. Here only some of the most popular automatic tools for web sites evaluation will be mentioned. Also one automatic evaluation tool is mentioned among the tools having mostly the same abilities.

#### **1.3.3.1 Web XM**

WebXM is used to automate inspection of some page defects. These defects include broken links, spelling errors, slow loading pages, poor search and navigation to help improve usability of the web site. WebXM automates more than

170 accessibility checks, namely appropriate text and background color contrast or the presence of text equivalent “alt” tags on images. These accessibility checks ensure the accessibility of a web site for disabled people. The target of WebXM is to improve visitor experience. This target is obtained by exposing usability issues that may be causing visitors keep themselves away [19].

#### **1.3.3.2 Booby**

Bobby is a web accessibility testing tool. It is designed to help remove barriers on accessibility issues. It also encourages compliance with existing accessibility guidelines, including Section 508 of the US Rehabilitation Act and the W3C's Web Content Accessibility Guidelines (WCAG) [9]. Bobby examines every page of a website and tests every page of web site individually. Then it checks the web site for several accessibility requirements. These requirements cover readability by screen readers, the provision of text equivalents for all images, animated elements, audio and video displays.

Bobby has the ability to see local web pages including the pages behind firewalls. It performs over 90 accessibility checks. In an evaluation session it examines HTML for compliance with specific guidelines for generating report for each page of the web site. A syntactic analysis is applied for HTML code.

There are three priority levels according to WAI. These levels base on definition of guidelines, checkpoints and priorities. For each guideline appliance of content development scenarios are explained in checkpoint definitions [20]. Each checkpoint has one of the three priority levels according to the affect on accessibility issues. Eventually, the three conformance levels base on the satisfaction of all checkpoints of an increasing number of priority levels.

### **1.3.3.3 NIST Web Metrics**

The US National Institute of Standards and Technology (NIST) has developed prototype tools. These tools aim to evaluate web site usability [10]. There tools are WebSAT, WebCAT, WebVIP, FLUD, FLUD Viz, VisVIP and TreeDec.

#### ***1.3.3.3.1 WebSAT***

The Web Static Analyzer Tool (WebSAT) is a prototype tool that inspects the HTML code of web pages for usability problems. WebSAT allows the webmaster to investigate these problems. Then webmaster can remove these problems from the web page design. WebSAT not only applies its own set of usability rules but also applies the IEEE Std 2001–1999 (NIST 2001b).[11] Likewise Bobby, accessibility is measured in accordance with the three priority levels suggested by WAI recommendations [9].

#### ***1.3.3.3.2 WebCAT***

The Web Category Analysis Tool (WebCAT) allows webmaster to conduct a simple category analysis in the web quickly [7]. This is based on traditional card sorting techniques. The webmaster creates a set of categories and a number of items which are to be assigned by test subjects to the categories. Then the webmaster can compare the real assignments with intended assignments which will meet user needs.

#### ***1.3.3.3.3 WebVIP***

The Web Variable Instrumenter Program (WebVIP) allows rapid instrumentation of a web site by the webmaster. This way webmaster can capture a log of user

behavior on the site. After the instrumentation of the web site, test subjects are asked to complete tasks. Their interactions like manipulating buttons and checkboxes and navigating among pages are captured in a log file. This file is analyzed later. After the analysis user interaction patterns are determined [7].

#### ***1.3.3.3.4 FLUD***

The FLUD (Framework for Logging Usability Data) provides a representation of user interaction. User interaction shall be convenient for usability test that means interaction shall be general enough to support the test [21]. The Framework for Logging Usability Data consists of a file format and a parser for representation of the behavior of website users. The log data is used for analyzing and improving the usability of web applications. As captured data is complicated a file format is needed to allow various software components to exchange information.

#### ***1.3.3.3.5 FLUD Viz***

The FLUDViz tool provides web master to visualize and analyze a single usability session. Two dimensioned x and y axis are used. The x-axis is used for time, and the y-axis is used for the types of behavior. Webmaster can zoom and pan in the time dimension. The webmaster can also filter activity type in the Y dimension.

#### ***1.3.3.3.6 VisVIP***

The VisVIP tool uses data captured by FLUD. Webmaster visualizes navigational paths of website users in three dimensional graphics and also analyzes it. VisVIP has the ability to show visited pages on a two dimensional graphic. This graphic is generated by VisVIP automatically. Time spent on the pages by visitors also indicated by a vertical bar. VisVIP may be used to capture repeated patterns of navigation.

#### ***1.3.3.3.7 TreeDec***

The TreeDec tool is a support tool for web site designers. It represents the web site as a logical tree. All links are displayed on the tree. This lets webmaster to analyze links and take necessary measures to facilitate navigation [12].

#### **1.3.3.4 Alexa**

Alexa computes traffic rankings by analyzing the Web usage of Alexa Toolbar users. The information is sorted, sifted, anonymized, counted, and computed, until, finally, traffic rankings are shown in the Alexa service.

The traffic rank is based on three months of aggregated historical traffic data from Alexa Toolbar users and is a combined measure of page views and users (reach). As a first step, the reach and number of page views for all sites on the Web are computed on a daily basis. The main Alexa traffic rank is based on the geometric mean of these two quantities averaged over time (so that the rank of a site reflects both the number of users who visit that site as well as the number of pages on the site viewed by those users). The three-month change is determined by comparing the site's current rank with its rank from three months ago. For example, on July 1, the three-month change would show the difference between the rank based on traffic during the first quarter of the year and the rank based on traffic during the second quarter.

In addition to traffic details Alexa also provides some sort of services for related links, sites linking in and web sites visited by visitors of evaluated web site.

#### **1.3.3.5 Dr. Watson**

Dr. Watson is hosted as a free service by Addy & Associates (2000). Watson checks per HTML 3.2, as well as Netscape and Microsoft extensions up through

version 4.x. Watson can also check other aspects of a site, including link validity, download speed, search engine compatibility, link popularity, word count, and spelling. No specific accessibility checking.

#### **1.3.3.6 Link Alarm**

LinkAlarm (<http://linkalarm.com>) is a link validation service for web sites. It checks every link on every page of a site, from your users' perspective. When LinkAlarm has finished checking a site, it sends an email message indicates that the report is ready.

#### **1.3.3.7 Keynote**

Keynote has built a global test and measurement infrastructure to provide Internet perspective on Web performance. Keynote measures, monitors, diagnoses and tests the performance of Web applications, including those built using Web Services, from inside and outside of the web sites firewall, and delivers easy-to-interpret metrics through the Keynote Web Portal e-mail reports.

#### **1.3.3.8 AnyBrowser**

AnyBrowser.com is a web site that offers free tools to find out how to make a website viewable for the majority of visitors. They created the AnyBrowser specification that defines what tags you are allowed to use if you want your site to be viewable by the majority of Internet users. This website also offers link checker [22].

#### **1.3.3.9 LPC**

Link Popularity Check [16] is a freeware program that checks the link popularity status of a web site on several search engines and compares it to other web sites on the Internet (for example its competitors).



#### **1.3.3.10 Web Tango**

WebTango has developed at Berkeley for statistical analysis [15]. It does not use any actual guideline set. It applies a very interesting approach. Reverse engineering is applied for web sites that are considered as high quality web sites. Characteristics of the web sites are extracted and these are used to evaluate other web sites.

#### **1.3.3.11 WebRemUsine**

WebRemUsine [13] uses a specialized task-action model to add semantic hints to the syntactic analysis. Initially a temporary modeling phase is applied. In this phase evaluator connects each elementary user task to the sequence of navigation actions that he/she considers to be optimal. The task model uses the notation of ConcurTaskTrees [14]. Moreover, user action logging ability and ability to relate collected data with the tasks added to web browsers. These tasks are high level tasks wanted to be performed by users.

### ***1.4 Web site Measurement Tools Comparison***

As there are various automated or semi automated web site evaluation tools most are concentrated on a specific area. When evaluating a web site it is necessary to use a couple of different web site evaluation tools which increases workload and complicates keeping historical data on an integrated environment. Ad hoc evaluations are mostly necessary to specify the current situation of a web site but when we need a development report of a web site and its competitors by the help of historical data which is not stored in many of the web site evaluation tools it is not easy to use a systematic report mechanism that would need an accurately formed data warehouse.

Automation of overall web site evaluation is not that easy and some of the web site owner companies or institutions might not need an overall evaluation. Even automated tool developers concerning with every means of web site evaluation gather some related issues in different tools (NIST Web Metrics) [10]. This approach may be profitable when users need only some specific aspects but an overall evaluation tool with integrated report capabilities shall not be ignored. This will not only keep historical data that may be used for historical data reports and comparisons of such data with competitor web sites but also provide a systematic approach for over all web site evaluation.

**Table 1 Comparison of Specific Web Site Evaluation Tools**

	Accessibility	Identity	Navigation	Interactivity	Comprehensibility	User Behavior Watch	Personalization	Performance	Security	Design Patterns	Information Quality	Content Comparison	Traffic Ranking	Compatibility	Link Validation	Link Popularity
Web XM	X		X													
Booby	X		X													
NIST Web Metrics	X		X			X										
Alexa						X							X			
Dr. Watson														X	X	X
LinkAlarm															X	
KeyNote								X								
AnyBrowser														X	X	
LPC																X
WebTango										X						
WebRemUsine						X										
SAWSET	X	X	X	X	X		X	X	X		X	X	X	X	X	X

Table 1 presents a simple comparison of specific automated web site evaluation tools and the project SAWSET (Semi Automated Web Site Evaluation Tool) developed in the context of this thesis. An “X” in the Table 1 indicates that web site evaluation tool covers relevant evaluation criteria.

As it is clearly seen from the Table 1 each tool concentrates on one or a couple of specific area. Tools excluding SAWSET are fully automated. As the subjects of comparison are general each tool has different abilities or uses different approaches for evaluating even the same subject. Determining and implementing a guideline for web site evaluation depends on the approach of the evaluator.

Fields signed by “X” in the table do not specify that every tool evaluating that specific area covers same evaluation metrics. This table is meant to indicate that an overall evaluation is not generally implemented. In SAWSET tool the intention is to implement a web site evaluation that covers most important aspects of web site evaluation and to automate specific evaluation processes.

## **CHAPTER 3**

### **APPROACH**

#### ***1.5 Purpose and Scope***

Our aim is to evaluate a web site depending on specified methods covering most important aspects of a web site. For this purpose a web site evaluation approach used in Middle East Technical University Informatics Institute E-transformation lessons is adopted [32]. This approach consists of two main topics; Structural Evaluation and Content Evaluation [25]. Structural evaluation covers eight evaluation sections; Identity, Loading and viewing, Navigation, Interactivity, Comprehensibility, Personalization and Content, Information Quality and, Up to datedness and Security [27]. Content evaluation covers determining and comparing the contents of web sites. This approach not only does introduce an evaluation method but also includes a report generation system which uses historical data for reports to indicate the development of a web site or specified scope of business. It is also aimed to minimize the workload by automating some specific processes that explained in detail in this chapter which will also increase the objectivity of evaluation.

This approach is developed to evaluate any kind of web sites especially public or private web sites which reveal information about their products or services on a

specific scope of business. Content evaluation is meaningful when compared to content evaluation results of a web site in the same scope of business.

### ***1.6 Assumptions and Dependencies***

It is assumed that evaluated web sites shall be in the same scope of business to generate meaningful comparison reports as comparing web sites in different scope of businesses may not indicate meaningful results.

Each company or institution shall have one domain name hosting only relevant information and services about the company or institution within the said domain. Each company or institution to be evaluated shall only be included in one scope of business; multiple scope of business ownership is not allowed.

Only completed evaluation results shall be included in report generation phase.

### ***1.7 Structural Evaluation***

Structural Evaluation consists of a questionnaire formed by eight basic evaluation topics. Totally there are 98 questions that are indicated in each topic. Each question has a weight depending on its importance for evaluation process. Weights of the questions are determined using empirical data obtained during the evaluations made in the context of E-transformation lessons in Middle East Technical University Informatics Institute [33].

Structural evaluation questions include both objective and subjective questions. It is aimed to apply automatic evaluation for objective questions. However subjective questions may produce different results depending on the evaluator nevertheless

these results are needed to cover all important aspects of web site evaluation. This deficiency may be overcome by using more results from different evaluators. As the number of evaluators increase the calculated average will be less subjective.

Questions are Yes/No Questions and unless otherwise specified in the explanations for questions, every "Yes" answer means that total weight for the relevant question will be given to the company for satisfying the needs of the question. Weight portions for the questions including more than one question are explained under the relevant topic.

Table 2 shows structural evaluation topics and their weights out of 1000 total value for Structural Evaluation.

### **1.7.1 Identity**

Identity information shall provide users recognition about the Web Site Owner Company / Institution and the Web Site. As this evaluation approach targets web sites of companies and institutions in a scope of business eleven basic questions are determined. These questions (Table 3) cover the information that specifies the web site and company / institution such as company logo, organization chart, site map, services, resources, means of communication such as email / mail addresses, telephone / fax numbers of web site developers and managers.

Question 5 is used to determine the availability of both telephone and fax numbers. 10 points are given for telephone number and 5 points are given for fax number.

Question 10 is used to determine the availability of aids, tools and help resources. 3 points are given for aids and help resources and 4 points are given for tools.

**Table 2 Weights for Structural Evaluation Topics**

	Structural Evaluation Topics	Weight
1	Identity	120
2	Loading and viewing	125
3	Navigation	125
4	Interactivity	150
5	Comprehensibility	100
6	Personalization and Content	150
7	Information Quality and Up-to-datedness	125
8	Security and Miscellaneous	105
	TOTAL	1000

**Table 3 Identity Questions**

	Identity Questions	Weight
1	Includes a corporate / brand logo	10
2	Includes an organization chart	10
3	Includes e-mail addresses of the staff	10
4	Includes mailing addresses of the staff	15
5	Includes telephone/fax numbers for the staff	15
6	Includes Web Master address	15
7	Includes a site map	10
8	The site has been reviewed by an agency	10
9	Terms of service available	10
10	Includes aids, tools and help resources	10
11	Does the domain of the site (e.g. edu, com, gov) influence the evaluation?	5
	TOTAL	120

### **1.7.2 Loading and Viewing**

Loading and viewing covers some of the usability and accessibility measures regarding web sites. Loading and viewing is not relevant to the quality of information or services revealed on the web site but these measures are very

important to make web site visitors spend time on the web site. If it is not a must people will tend to use web sites they feel comfortable. If pages of a web site loaded slowly, incompatible with visitor's browser, there are interruptions for access etc. visitor will not feel comfortable and this will also affect the credibility of company / institution. To evaluate loading and viewing information of a web site questions in Table 4 are determined.

**Table 4 Loading and Viewing Questions**

	Loading and Viewing Questions	Weight
1	Pages load quickly	15
2	Site is platform and browser independent	10
3	Has 24x7x365 user access	5
4	Dynamic accessibility is fast	10
5	Page formats are standard	10
6	Graphical user interface standards have been used	10
7	Colors pictures and images are consistent, relevant and clear	5
8	Easy to read	10
9	Visual elements are used consistently	10
10	Audio available	5
11	Multimedia is downloaded effectively	10
12	Includes animations	10
13	Graphics and animations attract attention	5
14	Screen resolution sensitivity information available	5
15	Text is downloadable	5
	<b>TOTAL</b>	<b>125</b>

### **1.7.3 Navigation**

Any web site can have all kinds of great attractions, but if visitors don't know how to get to them, they'll just collect dust on the server. Worse yet, if visitors find a web site's navigation confusing or convoluted, they'll simply give up and head off



to explore the rest of the Web, never to return. So, good navigation design is an essential ingredient for any successful Web site [17].

To evaluate a web site for navigation measures twelve questions are determined as illustrated in Table 5.

**Table 5 Navigation Questions**

	Navigation Questions	Weight
1	Menu structure is present	10
2	Vertical scrolling is minimized	10
3	Horizontal scrolling is minimized	15
4	All pages include standard navigation options (back, forward, main page)	15
5	Navigation options are consistent and standardized on all pages	10
6	Links are meaningful and relevant to the subject	10
7	Explanations available for link titles	10
8	Links are not broken	10
9	On main page, it is possible to judge how the web site is organized and what options are available	10
10	Icons clearly represent what is intended	10
11	Navigation is fast	10
12	Navigation options give an impression of a professional design	5
	TOTAL	125

#### **1.7.4 Interactivity**

Interactivity is another evaluation topic including the features of interactivity between web site visitors and the web site. Interactivity features provide to obtain information or services web site user demands. Without using this means a web site may go no further than an information provider that does not show concern for web site visitors' changing demands. There are fourteen questions included in interactivity topic of Structural Evaluation. Interactivity questions table is given below:

**Table 6 Interactivity Questions**

	Interactivity Questions	Weight
1	Multimedia usage is effective	10
2	Printer-friendly version available	10
3	Access to required information requires minimum clicking	15
4	Keyword searching is available	15
5	Well programmed advanced search options are available	10
6	Dynamic information is available	10
7	Dynamic access to data is possible	10
8	User defined preferences are available	10
9	E-mail communication is present	5
10	Comments forum is available	10
11	Chat room is present	10
12	Questions bulletin board is present	10
13	Queries or complaints are resolved within 24 hours	10
14	FAQ pages are available	15
	TOTAL	150

### **1.7.5 Comprehensibility**

Comprehensibility evaluation is the most subjective topic for Structural Evaluation. Comprehensibility features are formed in eight basic questions. These questions and their weights are shown in Table 7 below. Question 5 determines the appropriateness of font size and availability of user control on font size. 5 points are given for the appropriateness of font size and five points are given for user control on font sizes.

### **1.7.6 Personalization and Content**

Personalization and Content topic covers specific services, registration process, registered user options, customization, personalization of interface, subscriptions

and contents of subscribed topics, system alerts, existence of e-library and pages under construction. Personalization and Content Questions and their weights are given in Table 8.

**Table 7 Comprehensibility Questions**

	Comprehensibility Questions	Weight
1	Cultural, artistic and traditional issues are covered	15
2	Number and type of links are meaningful	15
3	Forms to enter personal details are self explanatory	15
4	Turkish language is well used, spelling and grammar is correct	10
5	Font sizes are appropriate / Lets user control font size	10
6	Website is worth spending time	15
7	Website presentation is eye-catching	10
8	Website occupies the user and attracts attention/interest	10
	TOTAL	100

**Table 8 Personalization and Content Questions**

	Personalization and Content Questions	Weight
1	Website offers user specific services	10
2	Registration is simple	10
3	Main page contains options for new and registered users	10
4	Customization is possible	10
5	User interface can be personalized (users can accommodate personal preferences)	10
6	Subscription to a particular content is possible	15
7	Offers one-entry-one-exit option	10
8	Received information is helpful	10
9	Received information guides the user to other helpful sources	10
10	Users can easily reach the experts within the organization	15
11	The system alerts the users for updates	10
12	Do not Include pages under construction	10
13	On-line information is available	10
14	Includes an e-library	10
	TOTAL	150

### 1.7.7 Information Quality and Up to datedness

Information quality is a slippery subject. There is no absolute truth every time. For the information released on a web page the most important aspect is truth. Information quality of a web site shall be determined depending on correctness and the information shall be objective and complete. Incomplete information may result misunderstandings even if it is correct.

Up to datedness covers currency of information and means to reach the information such as links. Eleven questions are determined to specify information quality and up to datedness of web site and given in Table 9.

**Table 9 Information Quality and Up-to-datedness Questions**

	Information Quality and Up-to-datedness Questions	Weight
1	No incorrect information available	10
2	Information is up-to-date and date of recent revision is given	10
3	Content is appropriate for the intended audience	15
4	Original information is supplied	15
5	Links to other related sources are present	10
6	Links are given in a logical order	15
7	Links are up-to-date	10
8	Links are revised regularly	10
9	Date of information is given	10
10	Date of current version/last revision is given	10
11	Information about any planned updates or revisions is given	10
	TOTAL	125

### 1.7.8 Security and Miscellaneous

Web site security is a wide ranging subject. In this evaluation method, web site security is only covered for availability of main security measures such as SSL,

authentication, authorization, digital signature and privacy statement. Those measures are mainly for the security of web site visitors.

Also some specific measures not included in above topics are included in this topic.

**Table 10 Security and Miscellaneous Questions**

	Security and Miscellaneous Questions	Weight
1	Includes privacy statement	10
2	Authentication ability available	10
3	Authorization ability available	10
4	SSL (Secure Sockets Layer) is used	20
5	Digital signature is used	10
6	Website has received an award	15
7	Information can be printed without the need to change the original system configuration of the user	10
8	Page layout is suitable for printing in small segments	10
9	Website is available in more than one language	10
	TOTAL	105

There are also four questions to be answered that are not weighted but saved for information and report generation purposes. These are number of languages available, number of other websites given as reference, number of services provided and total number of pages of the website.

### ***1.8 Content Evaluation***

Content evaluation is simply determination of content topics of to be evaluated web sites, clustering same contents and preparation of a comparison report for evaluated web sites in the same scope of business depending on the specified contents [24].

The idea used for content evaluation may be explained as follows. As first to be evaluated web sites shall be thoroughly examined by an evaluator. Site maps may be a starting point but site maps shall not be used every time as is. Web site contents shall be decomposed by a determined clustering method otherwise content comparison of evaluated web sites will not be meaningful. After determining all content topics of web sites, for each content topic, a cluster shall be determined or a new cluster shall be created. For each cluster a content topic name shall be chosen that expresses the content topics included by this cluster. Other content topics will be kept as synonyms of the cluster name. After clustering content topics of web sites according to specified criteria a content comparison table shall be formed to visualize results.

Content evaluation is implemented in two phases. These phases are Content Decomposition and Content Comparison that are explained with the example below.

### **1.8.1 Content Decomposition and Content Comparison**

Content Decomposition process is carried out by the evaluator. As explained above it is the process of determining the whole content topics of a web site. Content Decomposition of a single web site provides content topics described as synonyms which shall be clustered with the other synonyms of web sites to be compared.

Assume that we have three web sites A, B and C. For each web site content topics are as follows:

Web site A: A1, A2, A3, A4, A5 and A8,

Web site B: B2, B3, B5, B6 and B7,

Web site C: C2, C5, C7 and C8.

If we suppose that numbers in the content topics indicate clusters then the clusters are;

A1 (A1),

A2 (A2, B2, C2),

B3 (A3, B3),

A4 (A4),

D5 (A5, B5, C5),

B6 (B6),

C7 (B7, C7)

C8 (A8, C8)

When there is only one content topic not relevant to others; this content topic shall also be defined as a cluster as in clusters A1, A4 and B6. For the second content topic group A2 is chosen as the cluster name among A2, B2 and C2 while B3, D5, C7 and C8 are chosen as cluster names for their groups. Cluster names may be the name of one of the content topics or any other name proper for cluster name. For example for the fifth cluster; D5 is determined as cluster name which is not included in the group.

After determining content topics and clusters a content comparison table is formed. Web site owner company or institution names are chosen from a scope of business. Optionally some of them may be excluded to see intended rivals in a table. For each web site a row is added and for each cluster a column is added. Sample content comparison table is shown in Table 11 below.

**Table 11 Sample Content Comparison Table**

	A1	A2	B3	A4	D5	B6	C7	C8	Total
A	X	X	X	X	X			X	6
B		X	X		X	X	X		5
C		X			X		X	X	4
Total	1	3	2	1	3	1	2	1	

According to content comparison table evaluator can sort web sites, determine commonly used content topics. Evaluator can also prepare development report by using historical data for a sector or a company / institution depending on changing content topics used in relevant periods.



# **CHAPTER 4**

## **IMPLEMENTATION**

### ***1.9 Introduction***

Web site evaluation approach defined in Chapter 3 was implemented in the scope of this Thesis. Proposed system was implemented web based to provide remote access for users needless of additional requirements. It is intended to host implemented software on a web server through which any user will be able to take advantage of this software irrespective of time and place by only having access to internet. Web based implementation of proposed system will also ensure remote management of admin functions.

Visual Studio .NET 2003 environment is used for software development and C# language is chosen. Microsoft SQL Server was selected for database implementation. General Description, Database Design and Software Requirements of proposed system are explained in detail in the following sections.

### ***1.10 General Description***

This application is for companies and institutions that are interested in evaluating their web sites according to the approach explained in Chapter 3. Said companies and institutions will be able to evaluate their web sites, keep their historical data and

reach these data when they need. This application will also provide these companies and institutions generate queries and reports for their web sites and for the scope of business they are associated. By the help of the information they acquired from the application they will be able to improve their web sites and follow their development according to evaluation periods they applied.

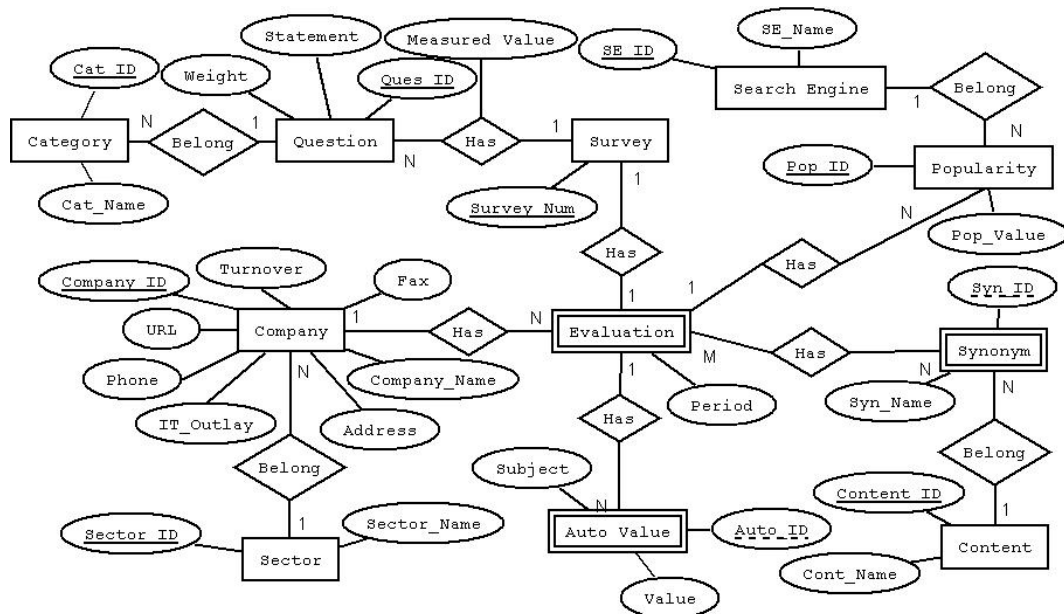
The application will also have automatic evaluation ability that will cover specific questions in structural evaluation. Automatic evaluation process is achieved by a spider crawls the web site and seeking answer for said questions depending on predefined rules. Automatic evaluation is explained in 1.12 Software Design in detail.

According to method chosen for using the application, evaluations will be made by responsible experts of companies or institutions or by a designated evaluation team. Queries will include company reports, scope of business reports and link popularity report. Reports will be generated for a company or for a scope of business.

As this application has partial automation for web site evaluation it is called as SAWSET, namely Semi Automated Web Site Evaluation Tool.

### ***1.11 Database design***

Relational model was used for database design [30]. MS SQL server was used to implement database design as database management system. Entity Relationship Diagram for SAWSET is given in Figure 1.



**Figure 1 Entity Relationship Diagram of SAWSET**

### 1.12 Software Requirements

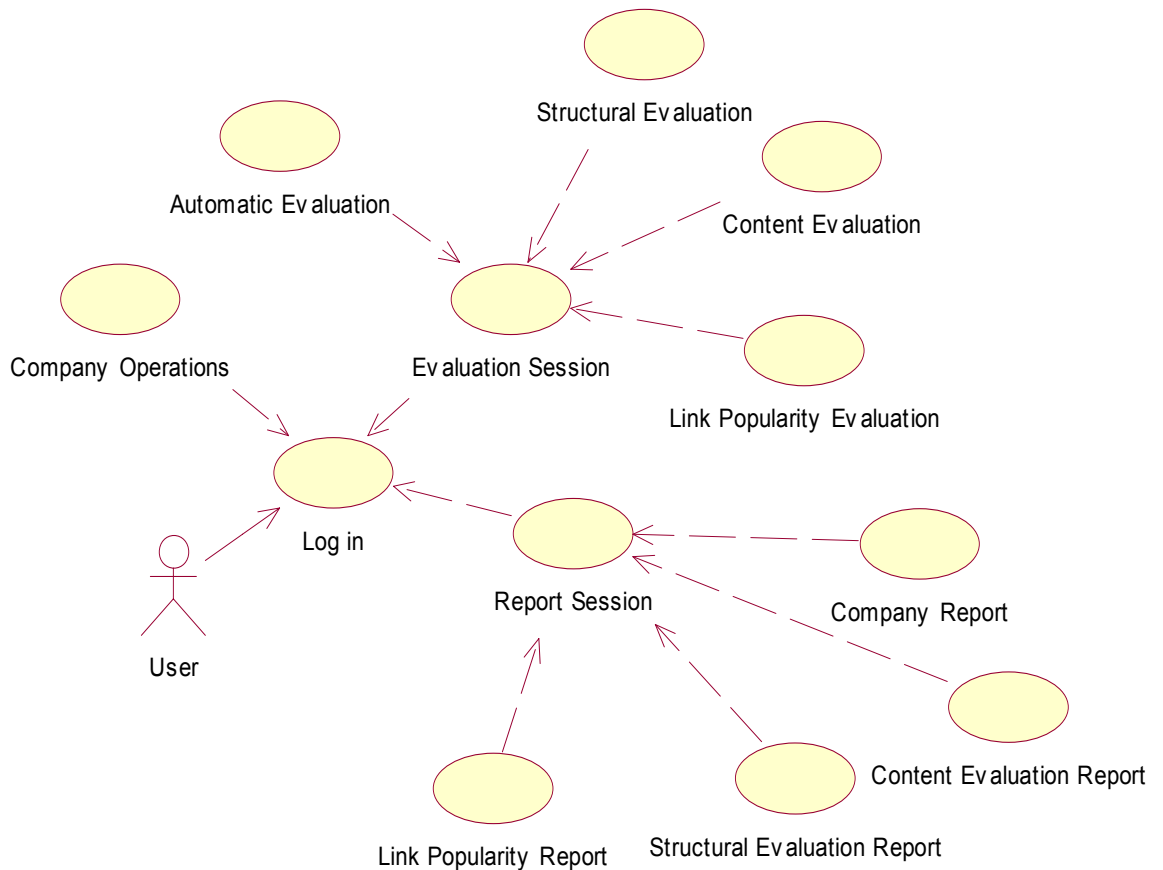
This section describes the software design for developing SAWSET . SAWSET is developed to run on the Microsoft environment with .NET Framework Version 1.1 and MS SQL Server.

This application is designed using Object Oriented Programming Approach. SAWSET has two user types; user and admin. Use Case Diagrams for user and admin are given in Figure 2 and Figure 22.

Software design is modeled by Use Case diagrams, activity diagrams and user interfaces depending on sequential using order of application by indicating algorithms and methods used in the application. This section is a useful source for anyone intended to implement functionalities mentioned in 1.13 Future Work.

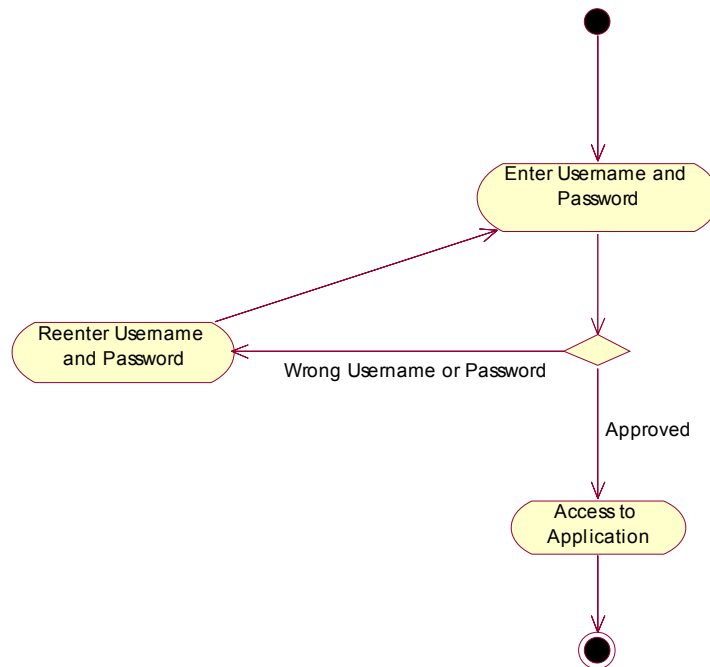
### 1.12.1 User

As shown in **Figure 2** below user has three use cases extending from log in use case which is the access point for all other use cases. These are company operations, evaluation session and report session. There are four use cases extended from evaluation session; automatic evaluation, structural evaluation, content evaluation and link popularity evaluation. Report session extends four use cases, namely company report, structural evaluation report, content evaluation report and link popularity report. All these use cases are explained below in detail by the help of activity diagrams.



**Figure 2 Use Case Diagram for User Actor**

## ***Log in***

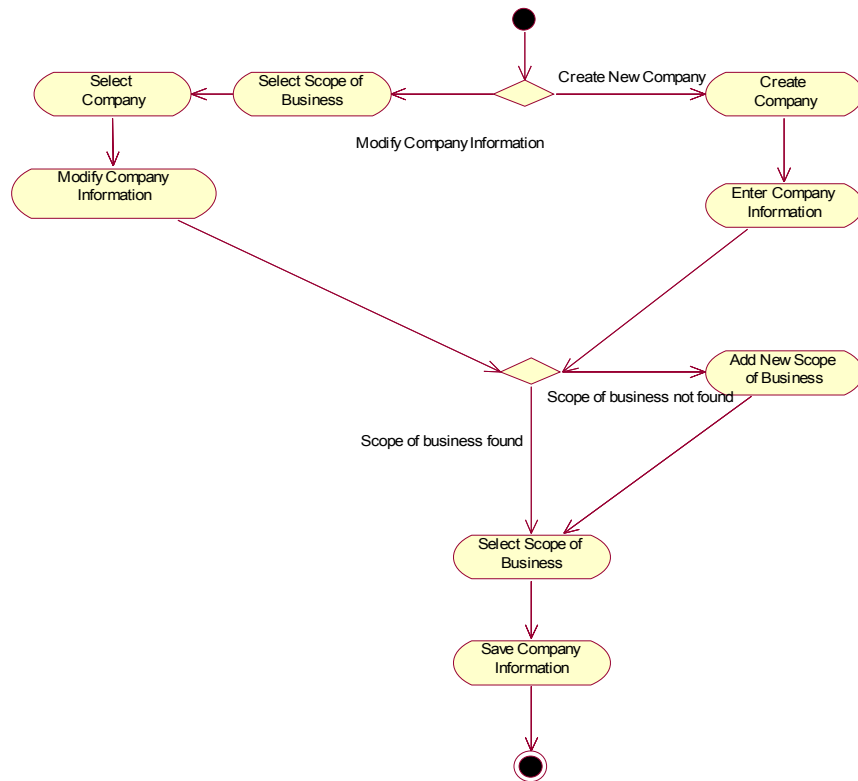


**Figure 3 Activity Diagram for Log in**

Log in page is the entry point to the application. User enters username and password. Authentication level of user is determined during log in and related functionalities are presented to user according to authentication level. Username and password are not case sensitive and account blocking is not applied for entering wrong password. Activity diagram for log in is given in Figure 3.

## ***Company Operations***

Before evaluating a web site of a company or institution necessary information must be saved. Fields saved in database are shown in Figure 5.



**Figure 4 Activity Diagram for Company Operations**

Company name, URL of company web site, scope of business and sector fields are mandatory. As described in Figure 4, user selects to create or modify company information. Enters company information and selects scope of business and saves company information to be able to create an evaluation. If scope of business of company is not available in database user can add new scope of business. After creating new company and adding it to database it is possible to modify company information. This process may be used to fulfill company information that is not completed during creation. Also mandatory fields may be modified such as company name, web site URL, and scope of business and sector which may change or entered wrong during adding new company.

SAWSET

Log out

**Company Information**

Company Name  \* Website URL  \* Ex : http(s)://www.metu.edu.tr

Phone  Scope of Business  \*

Fax  Address 1

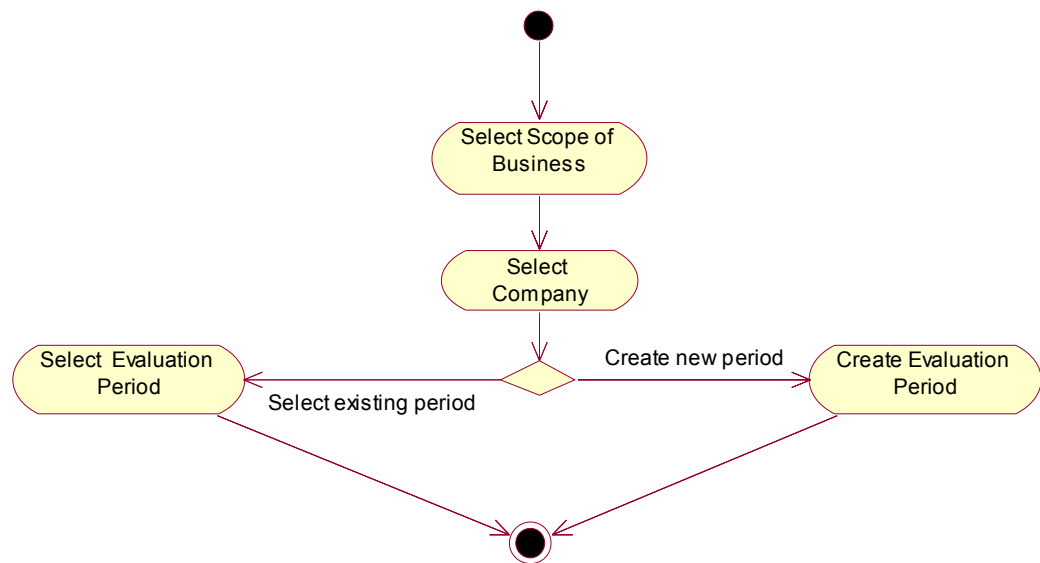
IT Outlay  Address 2

Company Turnover  Zip Code  City

Sector  \* Country

**Figure 5 User Interface for Company Information**

### ***Evaluation Session***



**Figure 6 Activity Diagram for Evaluation Session**

After creating a company or institution an evaluation shall be created to implement structural evaluation and content evaluation. First scope of business is selected from the dropdown list which was filled with all available scope of businesses

during page load. According to selected scope of business, company dropdown list is filled with available companies in database associated to selected scope of business. After selecting the company available evaluation periods for the company will be available in a dropdown list through which previously created evaluations may be selected and modified or completed. For creating a new evaluation period, period will be written in new period field after enabling it by deselecting checkbox next to existing period. Evaluation period format consists of two parts. First part indicates the year of the evaluation and second part shows the number indicating the number of evaluations for the scope of business through which scope of business comparisons will be applicable. Pressing "Progress" button will save the evaluation period for company or institution and evaluation session for created or selected period will start. Structural evaluation and content evaluation made will be saved for this selected or created evaluation period of the company or institution.

The screenshot displays the 'SAWSET' web application interface for 'WEB SITE EVALUATION'. The header includes a logo on the left, the title 'SAWSET' in the center, and a 'Log out' link with the 'FORMATICS INSTITUTE' logo and website address on the right. The main content area is titled 'WEB SITE EVALUATION' and contains the following elements:

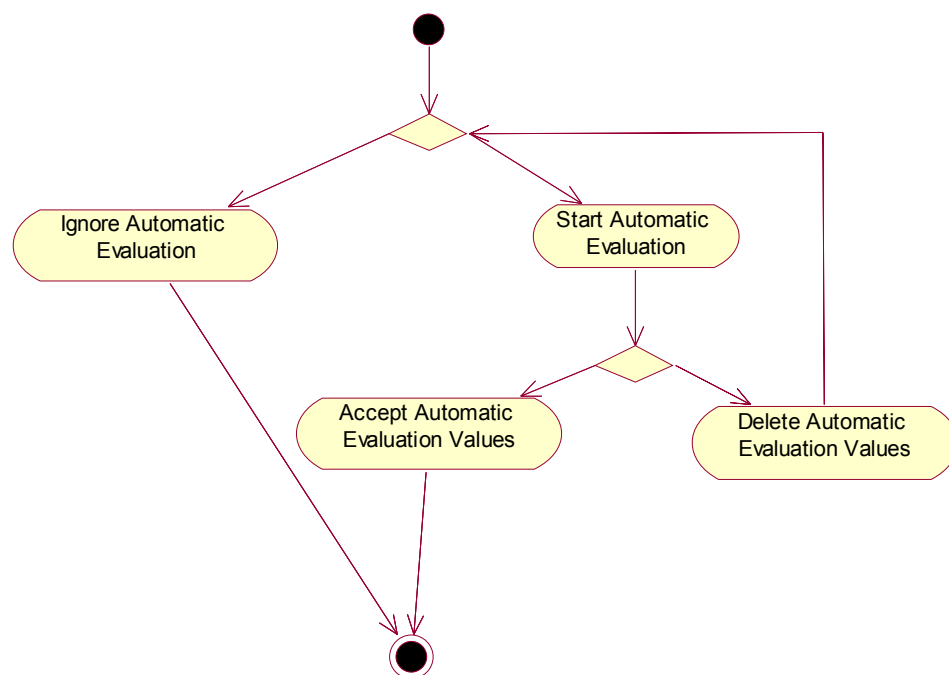
- 'Scope of Business' dropdown menu set to 'AUTOMOTIVE'.
- 'Company' dropdown menu set to 'MERCEDES', accompanied by an 'Add Company' button.
- 'Select an existing period' checkbox (unchecked) and a dropdown menu showing '2006/1'.
- 'New period' text input field containing '2006/2'.
- An example text: 'Example: 2006/2'.
- 'Main Menu' and 'Progress' buttons at the bottom.

**Figure 7 User Interface for Evaluation Session**



### *Automatic Evaluation*

After creating or selecting an evaluation period automatic evaluation process may be applied. Automatic evaluation is implemented by SAWSET spider that crawls the web site and looking for answer for some specific questions of structural evaluation given in Table 12.



**Figure 8 Activity Diagram for Automatic Evaluation**

Spider starts from the main page of the web site given in Company Information by user as web site URL. This field may be altered before starting automatic evaluation as shown in Figure 9. Spider gets given URL as start page and determines every link in this page and adds the links in the same domain to a queue. After finishing examining process of the page for automatic evaluation questions a new page is taken from the queue to examine for new links and

automatic evaluation questions. This process continues until there is no link left in the queue.

**Table 12 Automatically Answered Questions**

	Automatically Answered Questions	Remarks
1	Includes a corporate / brand logo	Information
2	Includes e-mail addresses of the staff	Information
3	Includes telephone/fax numbers for the staff	Auto value
4	Includes Web Master address	Auto value
5	Includes a site map	Auto value
6	Pages load quickly	Auto value
7	Page formats are standard	Auto value
8	Audio available	Auto value
9	Includes animations	Auto value
10	Links are not broken	Auto value
11	E-mail communication is present	Auto value
12	Comments forum is available	Auto value
13	Chat room is present	Auto value
14	Questions bulletin board is present	Auto value
15	FAQ pages are available	Auto value
16	Includes pages under construction	Auto value
17	Includes an e-library	Auto value
18	Links to other related sources are present	Information
19	SSL (Secure Sockets Layer) is used	Auto value
20	Number of other websites given as reference	Auto value
21	Total number of pages of the website	Auto value

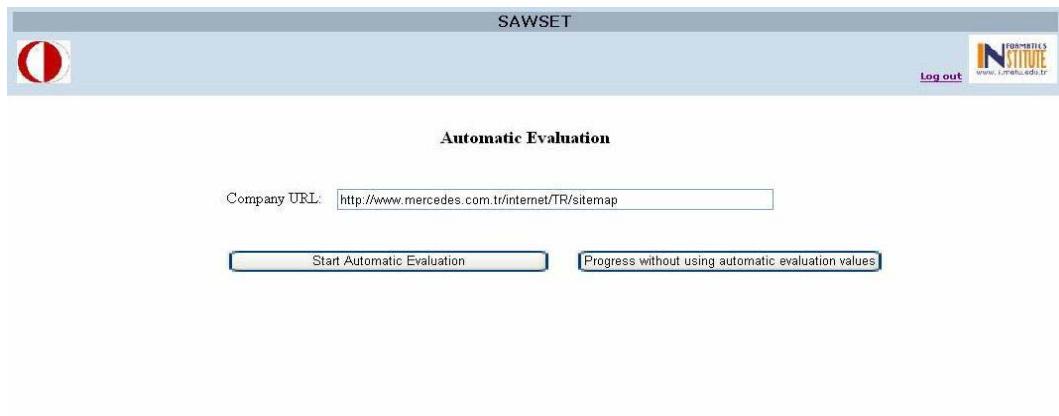
For each question answered or provided information by automatic evaluation specific methods are used. These methods are explained in detail for each question.

1. Includes a corporate / brand logo: Names of image files are searched for keywords “logo”, “emblem” and “amblem”.
2. Includes e-mail addresses of the staff: Text is detected for @ symbol and links are detected for “mailto” keyword. E-mail addresses are extracted and presented to user.
3. Includes telephone/fax numbers for the staff: Text is searched for keywords “telephone”, “phone”, “telefon”, “tel”, “fax”, “faks” and if there are numbers next to these keywords selected text is added to queue as found to be presented to user.
4. Includes Web Master Address: Found mail addresses are searched for keywords “webmaster” and “yonetici”.
5. Includes a site map: Links are searched for keywords “sitemap”, “site\_map”, “siteharita”, “site\_harita”.
6. Pages load quickly: Average page load time is calculated during crawling process and presented to user and also a value is given according to predefined method which uses thresholds for determining said value.
7. Page formats are standard: Style sheets are searched.
8. Audio available: All commonly used file extensions (asf, avi, mpg, mpeg, mp3, ram, wav, wma) for audio files are searched in links and these links are presented to user.
9. Includes animations: All commonly used file extensions (anm, anc, ani, ans, avi, avs, awm, fla, m3d, mvf, qt, sec, swf) for animation files are searched in links and these links are presented to user.
10. Links are not broken: During crawling process all broken links are detected and presented to user. Web sites with no broken links are given total 10 points and for each 2% of broken link of all its pages 1 point is deducted.
11. E-mail communication is present: All detected e-mail addresses are presented to user and if they are not relevant to the subject user may alter the answer.

12. Comments forum is available: Links are searched for keyword “forum” and results are presented to user.
13. Chat room is present: Links are searched for keywords “chat” and “sohbet” and results are presented to user.
14. Questions bulletin board is present: Links are searched for keywords “bulletin”, “bulten” and “ilan” and results are presented to user.
15. FAQ pages are available: Links are searched for keywords “FAQ”, “SSS”, “frequentlyasked”, “frequently\_asked”, “sikcasorulan” and “sikca\_sorulan” and results are presented to user.
16. Includes pages under construction: Text, image file names and animation file names are searched for keywords “underconstruction”, “under construction”, “under\_construction”, “yapım aşamasında”, “yapım aamasında”, “yapım\_aşamasında”, and “yapım\_aamasında”.
17. Includes an e-library: Links are searched for keywords “e-library”, “e\_library”, “elibrary”, “e-kutuphane”, “e\_kutuphane” and “ekutuphane” and results are presented to user.
18. Links to other related sources are present: During the crawling process all outer links are saved and presented to user to specify if there are relevant links to answer this question.
19. SSL (Secure Sockets Layer) is used: Web site is checked if it uses SSL port with port number 443.
20. Number of other websites given as reference: Number of outer links is given.
21. Total number of pages of the website: Total number of pages of the web site is given including the broken links.

Automatic evaluation may not be applied to every web site as they do not give access to every page of web site by HTML links or require authentication. In such situations automatic evaluation may be ignored or deleted after realizing that web

site is not suitable for automatic evaluation. Activity diagram for user is given in Figure 8. After applying automatic evaluation and accepting evaluation values, these values will be processes and give auto values or provide information for user to determine a value to the questions given in Table 12. Auto values may be changed by user.



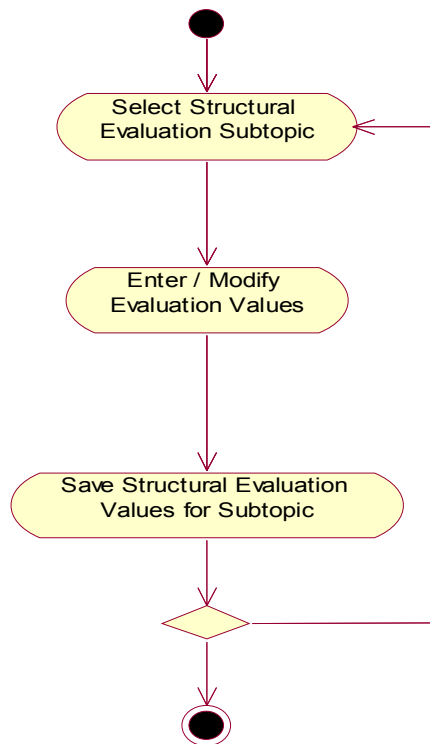
**Figure 9 User Interface for Automatic Evaluation**

SAWSET Spider is implemented on an open source spider implemented by Jeff Heaton [31]. Required classes are derived from the open source code and these classes are modified to meet the requirements of automatic evaluation part of SAWSET. Modifications include above mentioned abilities of SAWSET for automatic evaluation. There are five classes used to implement automatic evaluation, namely; SAWSETSpider, ParseHTML, Parser, AttributeList and Attribute. Class Diagrams for Automatic Evaluation are in Figure 10.

### ***Structural Evaluation***

Structural evaluation is implemented through eight separate web forms depending on eight structural evaluation topics as described in section 1.7. User enters evaluation values for each question in web forms. If there is an automatic

evaluation applied and accepted for this evaluation period of web site relevant fields appear filled with automatic values. These values may be regarded as suggested values and changed by user.



**Figure 11 Activity Diagram for Structural Evaluation**

Questions and their weights displayed by application come from database and altering a question or its weight can be applied by application for its text areas and controls.

User has to save entered evaluation values before going for another structural evaluation topic. Sequential order is not obliged. User may enter some of the values and leave the session and come back later to complete the evaluation as seen in Figure 11. User interface for structural evaluation is given in Figure 2.

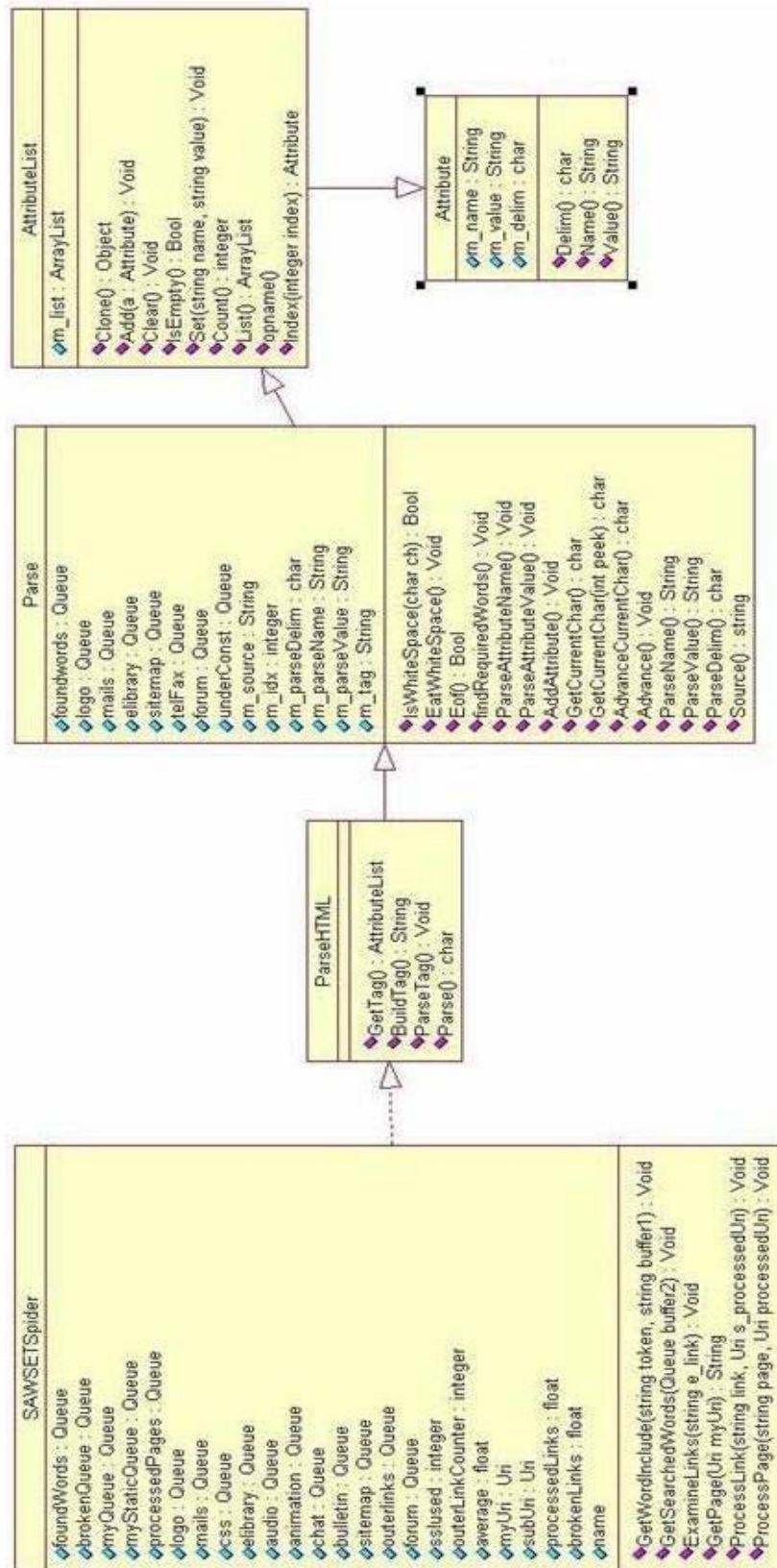


Figure 10 Class Diagrams for Automatic Evaluation

## Content Evaluation

Content evaluation shall be applied more than one web site in the same scope of business. Should content evaluation applied for only one web site this will not be meaningful as the results of this evaluation is compared to each other. According to the comparison results content coverage of a scope of business is determined. Also according to these results a web sites content coverage percentage in its scope of business is determined.

Content evaluation is implemented as described in section 1.8. Determined content topics of web site are regarded as synonyms. For each synonym, the process described in Figure 13 is applied. The synonym is searched in database. If found it is added to company synonym list.

WEB SITE EVALUATION	
IDENTITY	
Identity	
Loading and Viewing	Includes a corporate / brand logo
Navigation	Includes an organization chart
Interactivity	
Comprehensibility	Includes e-mail addresses of the staff
Personalization	Includes mailing addresses of the staff
Information Quality	Includes telephone/fax numbers for the staff
Security and Misc.	Includes Web Master address
Content Evaluation	Includes a site map
Popularity	The site has been reviewed by an agency
Back to Main	Terms of service available
	Includes aids, tools and help resources
	Does the domain of the site (eg. edu,com,gov) influence the evaluation?

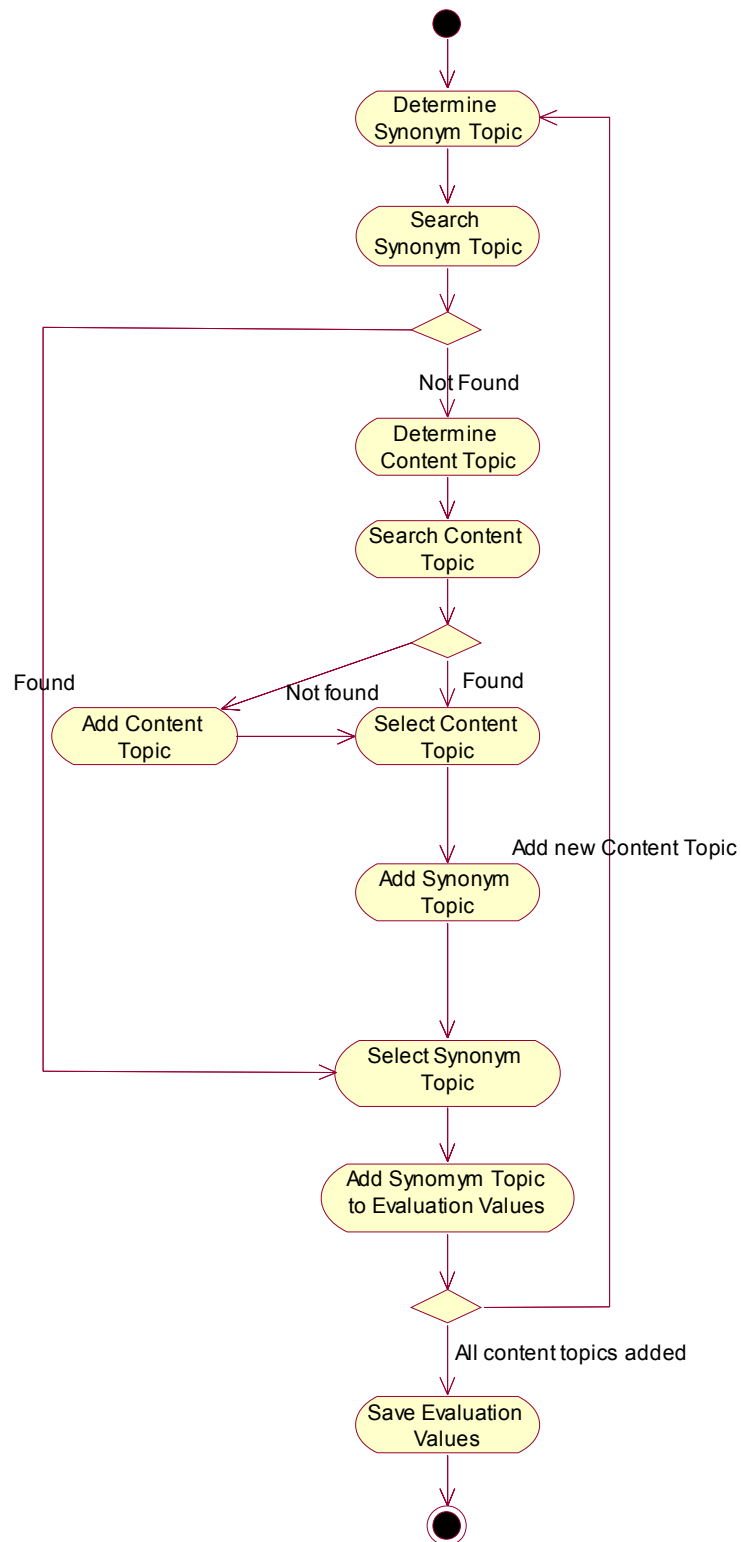
Figure 12 User Interface for Structural Evaluation



Otherwise convenient content topic is searched and synonym is added to synonyms of the content topic or a new content topic is determined and added to content topic list. For each content topic added to database a synonym with the same name is added to synonym list of relevant content topic. Then synonym is added to company synonym list. As seen in Figure 13, there is a choice to add the synonym as special synonym to a company.

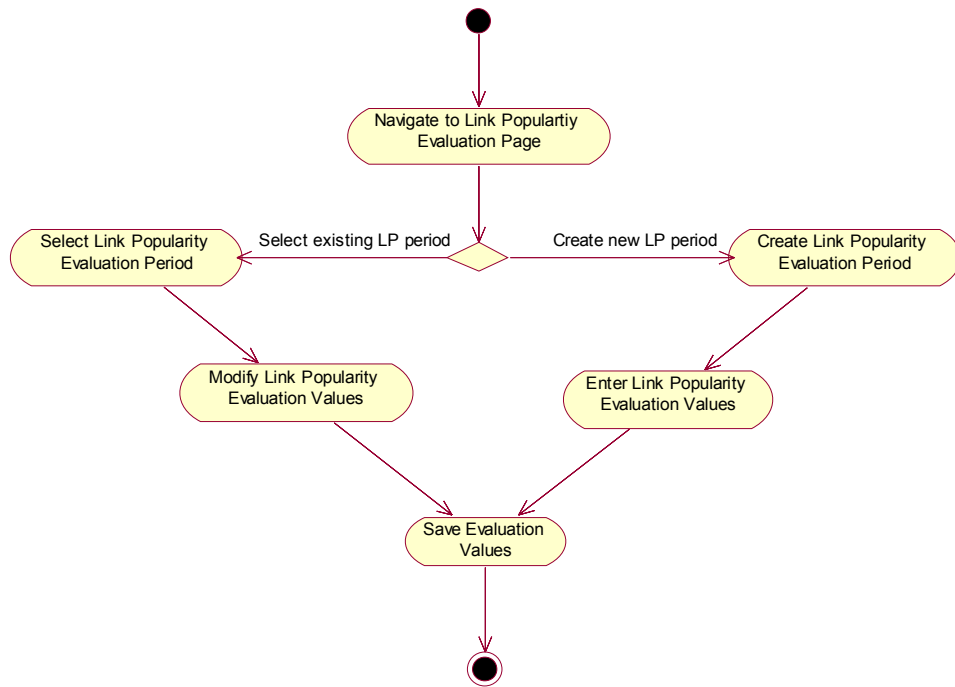
This choice is applied when a synonym includes words or brands only related the company or institution. This synonym is only viewed by Owner Company or institution. After adding all synonyms in the web site to synonym list values are saved. Content evaluation values may be accessed and modified later. Content Comparison is displayed in report session of the application.

**Figure 13 User Interface for Content Evaluation**



**Figure 14 Activity Diagram for Content Evaluation**

## *Link Popularity Evaluation*




**Figure 15 Activity Diagram for Link Popularity Evaluation**


Link popularity value of a web site is the total number of web sites that links to the web site [23]. Link popularity values differ depending on search engines as link popularity value is the number of web pages point to the web site in the index of the search engine [16]. For example, the link popularity value X for a web site retrieved from a search engine means that the search engine has at least X web pages in the index that link to the selected web site.

For link popularity values following search engines are chosen as they are most commonly used: AlltheWeb, AltaVista, Google, MSN Search and Yahoo.

These values are saved to generate a report depending on historical link popularity data of a web site.

SAWSET




[Log out](#)

**Structural Evaluation**

- Identity
- Loading and Viewing
- Navigation
- Interactivity
- Comprehensibility
- Personalization
- Information Quality
- Security and Misc.
- Content Evaluation
- Popularity
- Back to Main

Save your changes before going for another page

Scope of Business : LIBRARY

Company : ODTU

Evaluation Period : 2005/1/

AltThe Web

AltaVista

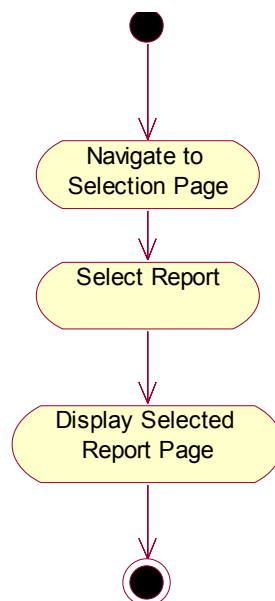
Google

MSN Search

Yahoo

**Figure 16 User Interface for Link Popularity Evaluation**

### *Report Session*

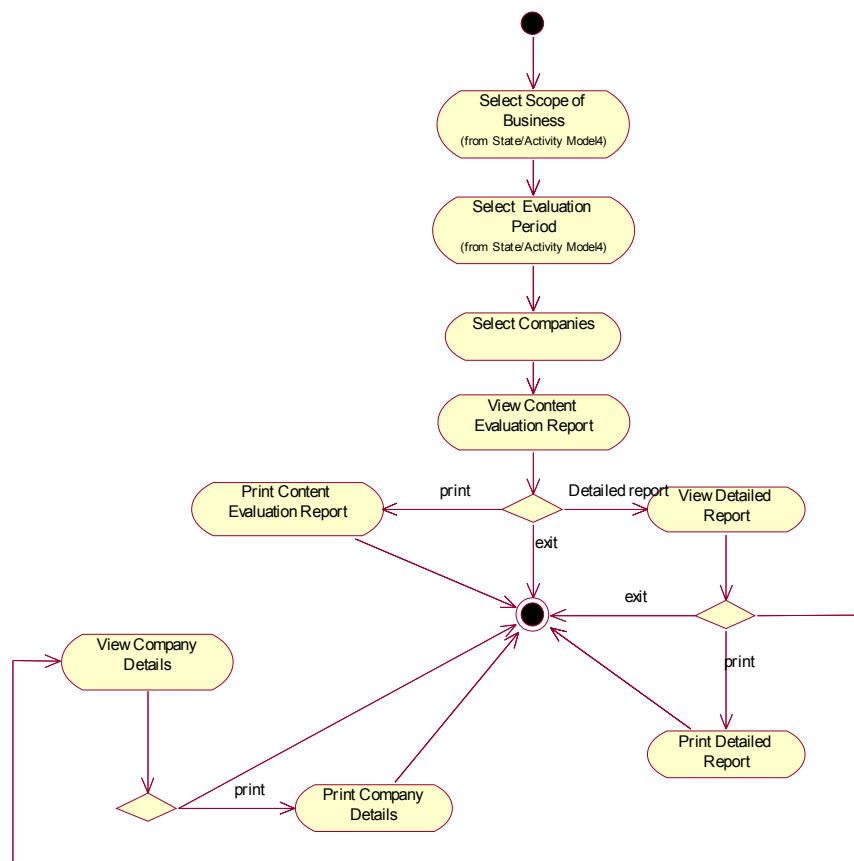


**Figure 17 Activity Diagram for Report Session**

Report session is used to access reports for web site evaluation, namely Company Report, Content Evaluation Report, Structural Evaluation Report and Link Popularity Report.

### ***Content Evaluation Report***

Content evaluation report generates a report for a scope of business regarding the distribution of content topics and number of content topics for each company or institution. As described in Figure 18, first scope of business and evaluation period is selected. Then companies or institution are displayed those were evaluated in selected period.



**Figure 18 Activity Diagram for Content Evaluation Report**

User selects the companies or institutions and content evaluation report is displayed. This report sorts companies and clusters them in five groups according to number of content topics they have. User may print generated report or select to view detailed report. Detailed report displays content topics of each company on a table which may be printed. Also company details report may be viewed that displays a printable table for content topics of a company.

In the content evaluation report grouping is achieved by using frequency chart. Following formula is used to compose frequency chart:

$$C = (R+1) / k$$

R= Range (Maximum Value – Minimum Value)

k= number of groups

Calculated value of “C” is added to minimum value hence bottom group frequency is determined. This process is applied for each top value and the higher level frequency is determined.

**Table 13 Sample Content Numbers Table**

	Company Name	Content
1	BALIKESİR UNI.	25
2	CANAKKALE ONSEKİZ MART UNI.	23
3	ADNAN MENDERES UNI.	23
4	AKDENİZ UNI.	18
5	ABANT IZZET BAYSAL UNI.	17
6	ATATURK UNI.	16
7	AFYON KOCATEPE UNI.	11

$$C = ((25 - 11) + 1) / 5 = 3$$

Frequency interval value is found 3. This value is added to related values to determine frequencies as mentioned above. First interval is calculated by adding this value to minimum value. Following intervals are calculated by adding the interval value to upper value of previous interval. Interval calculations for sample table are given in Table 14.

**Table 14 Frequency Chart Interval Calculations**

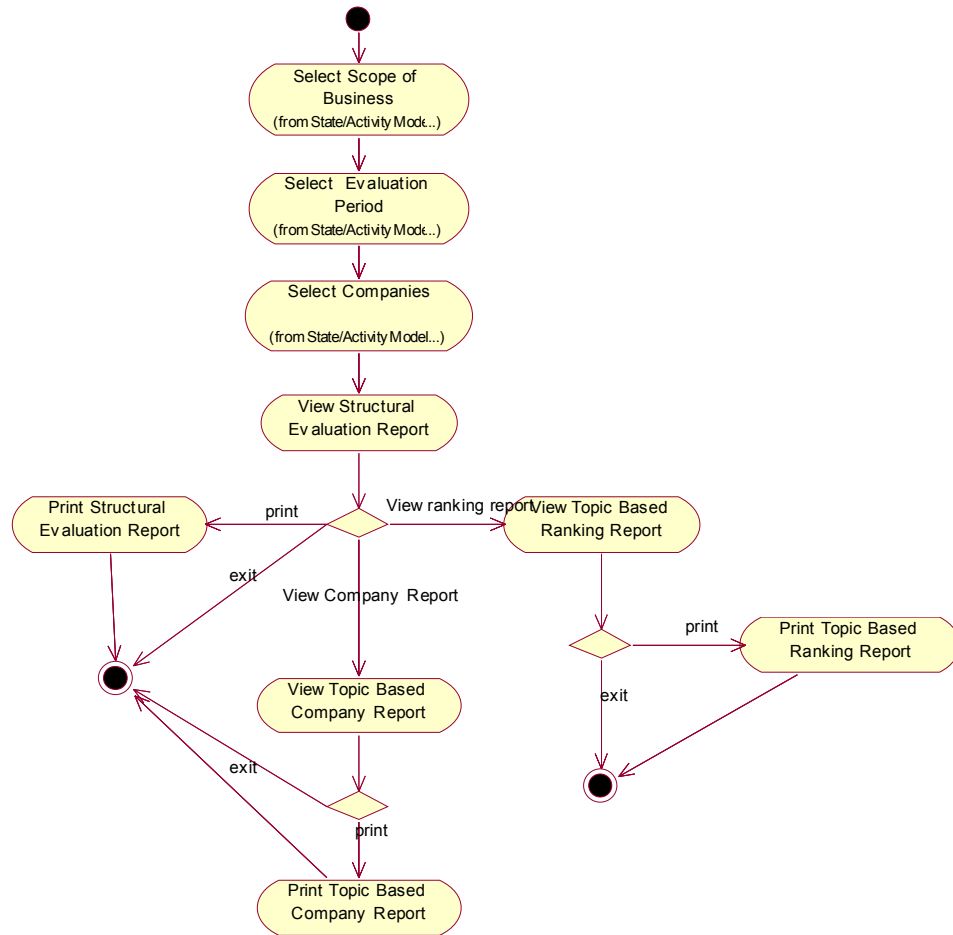
11 (Min Value)	≤	Bottom Interval	<	14 (11 + 3)
14 (Previous max value+1)	≤	Mid-bottom Interval	<	17 (14 + 3)
17 (Previous max value+1)	≤	Middle Interval	<	20 (17 + 3)
20 (Previous max value+1)	≤	Mid-top Interval	<	23 (20 + 3)
23 (Previous max value+1)	≤	Top Interval	≤	25 (Max Value)

Max value is the highest value in the content numbers table. By deducting the calculated “C” value from the max value and adding one to this value gives the minimum value of the top interval. Each interval is calculated by taking the bottom value of preceding interval and applying the same calculation to this value. This interval determination ends when Min value is reached. Min Value is the lowest value in the content numbers table. Content evaluation report samples generated by SAWSET are given in Appendices.

### ***Structural Evaluation Report***

Structural evaluation report generates a report for a scope of business displaying the structural evaluation results. Report presents the scores of companies depending on subtopics of structural evaluation. Details of each company for structural evaluation may be reached. Companies can be sorted according to each subtopic of

structural evaluation. Activity diagram for structural evaluation is given in Figure 19.

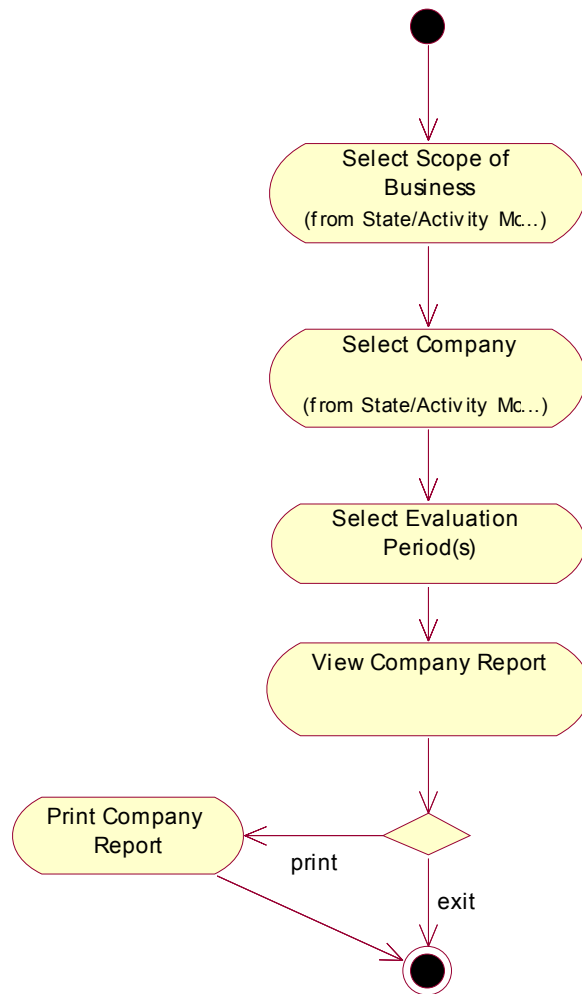


**Figure 19 Activity Diagram for Structural Evaluation Report**

### ***Company Report***

Company Report presents the structural evaluation values of a company or institution for selected periods. This information can be used to determine the development of the company for each structural evaluation subtopic. Activity Diagram for Company Report is given in Figure 20.

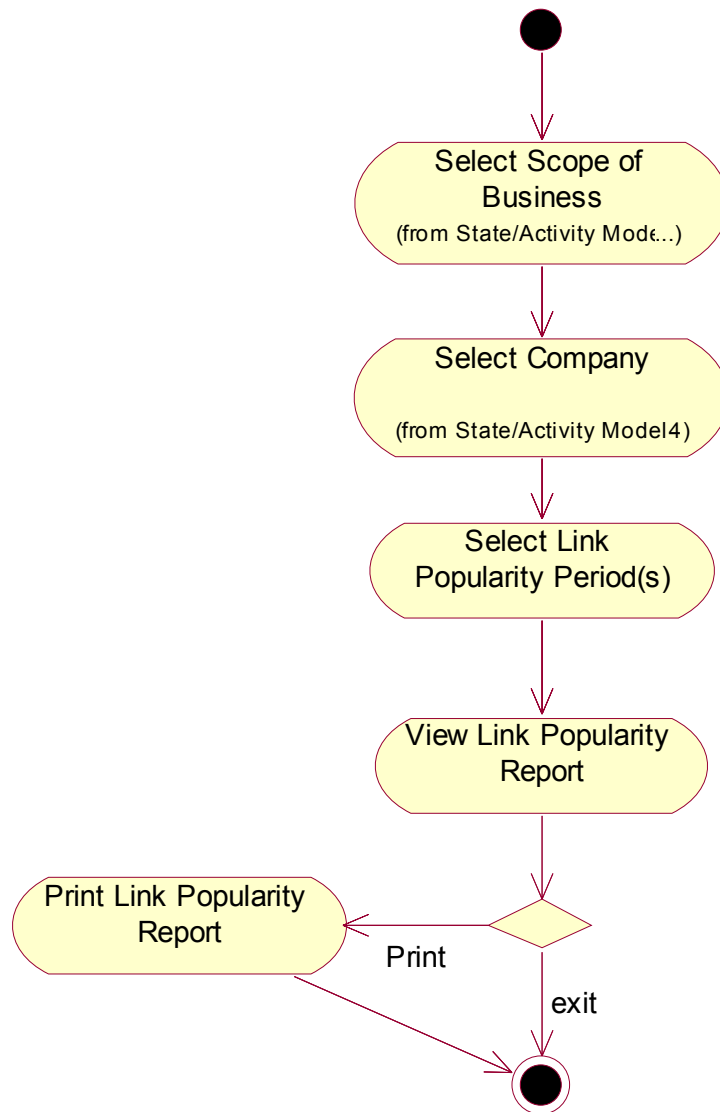




**Figure 20 Activity Diagram for Company Report**

### ***Link Popularity Report***

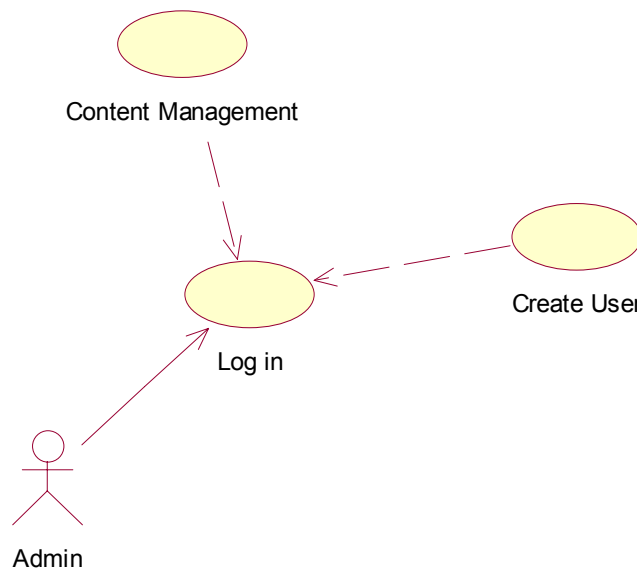
Link popularity Report presents historical link popularity evaluation data of a company. This information can be used together with company report to determine the development of a company. Activity Diagram for Link Popularity Report is given in Figure 21.



**Figure 21 Activity Diagram for Link Popularity Report**

### 1.12.2 Admin

Admin has two capabilities in addition to user capabilities, namely Manage Content and Create User. Use Case Diagram for Admin is given in Figure 22.



**Figure 22 Use Case Diagram for Admin Actor**

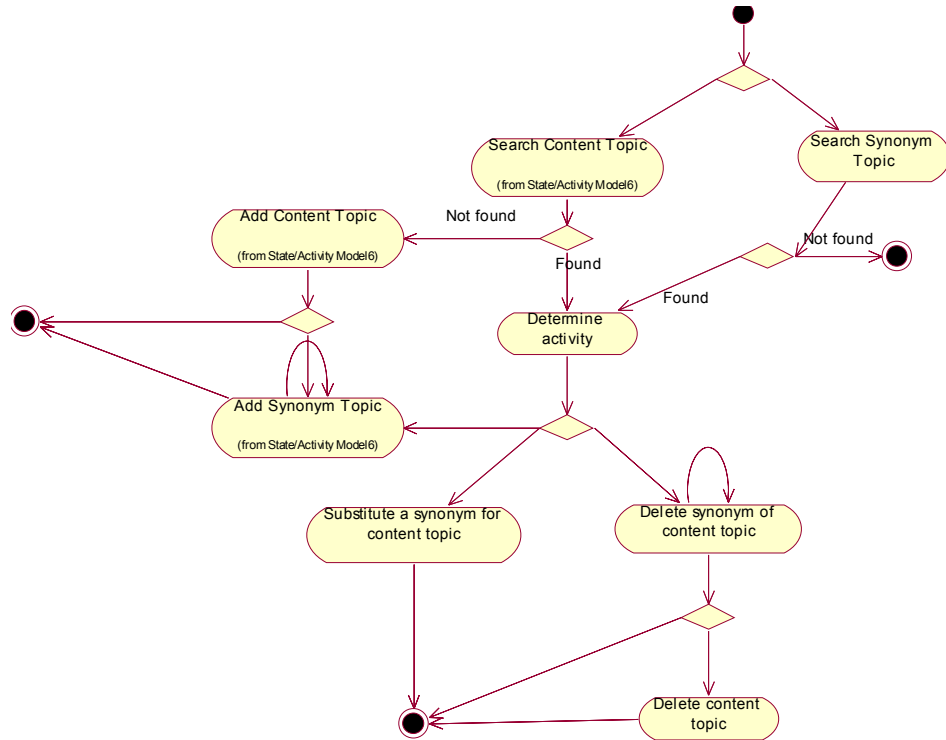
### ***Content Management***

Admin can manage content topics and synonyms using Content Management. In addition to adding and deleting contents, Admin is able to substitute a content topic with a synonym. This ability is used when user decides to change a content topic with a synonym which is determined as better representing the content among the synonyms. Activity diagram for Content Management is given in Figure 23.

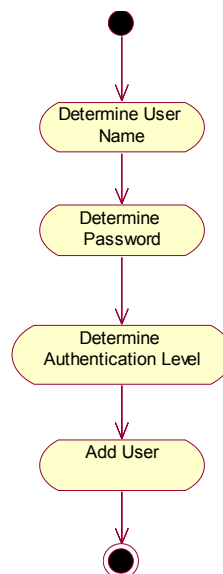
### ***Create User***

Admin can create user with admin or user authorization. As users are not associated to companies, admin may create multiple users for a company or create no user for a company. This decision depends on the approach of admin. Admin may only create users to apply evaluations and send related reports to companies or institutions or he/she may create users for any company to use SAWSET for

applying evaluations or generating reports according to their instantaneous demands. Activity diagram for Create User is given in Figure 24.



**Figure 23 Activity Diagram for Content Management**



**Figure 24 Activity Diagram for Create User**

## **CHAPTER 5**

### **JUSTIFICATION**

Evaluation method thoroughly explained in Chapter 0 was applied for University libraries [26] . Totally fifty one university libraries were evaluated. Evaluation results are used to assess abilities of the tool. Said evaluation values are added to SAWSET database by using the application. Using the evaluation values, reporting capabilities of the application are verified. In addition, automatic evaluation is applied for ten selected university libraries to compare manual and automatic evaluation values.

SAWSET not only keeps data to compare historical evaluation results for companies, but also generates detailed reports explained in Software Requirements. Considering the amount of data, it is a hard work to generate reports for evaluations. Choosing the right kind of report generation strategy decides the success of the application in terms of cost and performance. Data obtained and saved by SAWSET provides ample source to generate desired reports that may not be implemented in the context of this application. Tables of Content Evaluation Report and Structural Evaluation Report are given in Appendices. Examining these reports will indicate that manual preparation of such reports will take too much time. Also possible mistakes made during the preparation of reports may affect the reliability of overall evaluation process.

Automatic Evaluation ability of the application facilitates structural evaluation and shortens evaluation process. Some questions answered by automatic evaluation are time consuming and it is probable to miss some relevant information. For example counting the number of pages of a web site or outer links takes so much time or finding all broken links may not be possible as there may be some links not easily distinguished which is called as mystery meat navigation [28].

Automatic evaluation also helps to increase the objectivity of evaluation by specifying a standard for page loading speed. All other automatically evaluated questions provide information that may be overlooked.

Automatic evaluation can be applied for any web site regardless of the number of pages as long as the web site has HTML links to its pages. Pages reached by other means such as java buttons, scripts, flash buttons etc. are not reached by SAWSET spider implemented for this application.

Comparison is made for ten university library web sites applicable to automatic evaluation as explained above. Percentage columns for manual evaluation and automatic evaluation applied by SAWSET indicate correct answer percentage for relevant questions. As it can be clearly seen by examining Table 15 that manual evaluation seems less reliable with 81 % of correct answers to these questions whereas automatic evaluations has 93 % reliability for this example. As this application was intended to use a mixed evaluation, deficiencies of both evaluations will be eliminated.

Relevant comparison table is given below. Remarks of the signs used in the table are as follows:

S: Answers for the both evaluations are similar

A: Answer only provided by automatic evaluation is correct

M: Answer only provided by manual evaluation is correct

**Table 15 Comparison Table for Automatic Evaluation and Manual Evaluation**

	Abant	Afyon	Atatürk	Balıkesir	Çanakkale	Kocaeli	Mustafa Kemal	Sakarya	Selçuk	Uludağ	Manual (%)	SAWSET (%)
Includes a corporate / brand logo	M	S	M	S	S	M	S	S	A	S	90	70
Includes e-mail addresses of the staff	S	S	S	S	S	S	S	S	S	S	100	100
Includes telephone/fax numbers for the staff	A	S	A	A	M	S	S	M	S	S	70	80
Includes Web Master address	M	S	S	M	M	S	S	S	S	S	100	70
Includes a site map	A	S	A	S	A	S	S	S	S	S	70	100
Pages load quickly	S	S	S	S	A	S	S	S	S	A	80	100
Page formats are standard	M	S	M	S	S	M	S	S	S	S	100	70
Audio available	S	A	S	S	S	S	S	S	S	S	90	100
Includes animations	A	S	S	S	A	S	S	S	S	S	80	100
Links are not broken	A	A	S	S	A	A	A	S	S	A	60	100
E-mail communication is present	S	S	A	S	S	A	A	S	S	S	70	100
Comments forum is available	S	A	S	M	S	A	S	S	S	A	70	90
Chat room is present	S	S	S	S	S	S	S	S	S	S	100	100
Questions bulletin board is present	S	S	S	A	S	A	S	S	S	S	80	100
FAQ pages are available	S	S	S	S	S	S	S	S	S	S	100	100
Includes pages under construction	S	A	S	A	S	S	S	S	S	S	80	100
Includes an e-library	S	S	S	S	M	S	S	S	S	S	100	90
Links to other related sources are present	S	S	S	S	S	S	S	S	S	A	90	100
SSL (Secure Sockets Layer) is used	S	S	S	S	S	S	S	S	S	S	100	100
Number of other websites given as reference	A	A	A	A	A	A	S	S	A	A	20	100
Total number of pages of the website	S	A	A	A	S	A	S	S	A	S	50	100
Average success											81	93

## ***Discussion***

Considering the number of web sites automatic evaluation applied, it is not a decisive success of SAWSET. There are totally fifty one university library web pages that web site evaluation is applied manually. Automatic evaluation is only applied to ten university libraries. The number of university library web sites used for comparison of manual evaluation and automatic evaluation is not enough to justify the superiority of any of them. It must be also considered that automatic evaluation implementation is intended to support manual evaluation. This consideration may be sufficient to justify the usage of automatic evaluation for SAWSET. When automatic evaluation and manual evaluation is used together it is clear that reliability of the evaluation will be increased. Both evaluations will amend the other's deficiencies. Hence a more reliable structural evaluation will be achieved.

Manual and automatic evaluation comparison has another shortfall which is the comparison itself. It is clear that, if manual evaluation has tendency to make mistakes also checking the correctness of both values has tendency to make mistakes as it is another manual evaluation. However having two different evaluation values in the hand facilitates manual evaluation which may increase reliability of the evaluation anyway values determined as correct during manual evaluation for comparison may be incorrect.

Above mentioned shortfalls imply that comparison of manual and automatic evaluation values do not justify automatic evaluation as the superior evaluation choice. It only justifies that when automatic evaluation and manual evaluation used together they may correct each others mistakes and a more reliable evaluation may be achieved.



Results of the web site evaluation are given in reports. These reports provide a sorted list of evaluated web sites according to their points gained. Sorted list is clustered into five categories namely; top, mid-top, middle, mid-bottom and bottom (Appendices, Table D). The five level clustering is chosen as this classification is applied for web site evaluation results in many applications [24]. The most suitable and simple clustering technique for this kind of sorted lists is frequency chart. Frequency chart gives intervals according to the selected number of groups between the top and bottom values. For the sake of flexibility ability to modify interval values is provided to user in SAWSET.

## **CHAPTER 6**

### **CONCLUSION**

The Web has become an instrument for purchasing and exchanging goods, services and obtaining information. Companies and institutions are becoming more reluctant to own better web sites to increase their competitiveness and aware about the importance of their web sites to release information about their works. The key to winning this competitive race is knowledge about the needs of potential users and the ability to establish personalized services that satisfy these needs [29]. Web site evaluation process contributes to this knowledge and provides information to develop the web site according to user needs.

Application developed in the context of this thesis facilitates the evaluation process and provides information to web site owners. As historical data is kept users of this application will be able to reach useful information regarding their web sites. This information not only helps web site owners to realize the deficiencies of their web sites but also gives a comparison with its rival web sites to determine a roadmap to take necessary measures.

#### ***1.13 Future Work***

Considering the contents of web sites of 1990s rapid change in web site contents and new services and abilities of web sites are clearly understood. This evaluation method should be consistently updated according to newly introduced technologies and services.

As explained in Table 1 SAWSET application does not have User Behavior Watch and Design Patterns abilities. These abilities may be added to this method.

Also the number of automatically answered questions may be increased. In addition web crawling process may be developed to reach every type of web site not using HTML links to its pages. As it can be seen in Table 15, SAWSET has 93 % reliability. Reliability levels of the questions may be increased by adding new functionalities.

For better use of this application authorization abilities may be improved. Different user types may be defined to restrict the access of different levels of users to specific information. Also admin abilities shall be improved to satisfy this need.

Structural Evaluation questions are grouped in eight topics. But there are correlations between questions in different groups. Factor analysis may be applied to these questions. According to the result of factor analysis these groups may be decreased. Hence the confusing situations caused by high correlation between the questions in different groups will be removed.

### ***1.14 Contribution***

Implemented web site evaluation tool was intended to be used by designated administrators with information about this method. Evaluation may be applied by administrators or users according to current situation. But if users are not aware of the importance of content topic determination process content evaluation and comparison may not indicate expected results. Users executing evaluation shall be fair and use same systematic for giving a score for each question.

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## APPENDICES

### APPENDIX A STRUCTURAL AND CONTENT EVALUATION REPORTS

Table A Structural Evaluation Report General Table

Structural Evaluation For LIBRARY Period: 2005/1									
	1	2	3	4	5	6	7	8	Total
ABANT IZZET BAYSAL	55	75	86	43	44	45	57	20	425
ADNAN MENDERES	51	70	73	55	39	37	45	15	385
AFYON KOCATEPE	68	79	94	43	42	20	77	30	453
AKDENİZ	44	48	60	48	19	30	43	10	302
ANADOLU	71	98	102	92	51	49	97	40	600
ANKARA	51	66	76	53	41	58	50	10	405
ATATÜRK ÜNİ.	51	88	85	48	47	35	43	10	407
BALIKESİR ÜNİ.	54	90	70	65	38	50	80	10	457
BOĞAZICI ÜNİ.	53	57	82	60	31	55	52	40	430
CANAKKALE ONSEKİZ MART ÜNİ.	57	87	96	70	41	78	60	30	519
CELAL BAYAR ÜNİ.	35	53	79	51	46	40	60	40	404
ÇUKUROVA ÜNİ.	56	82	99	47	51	50	87	30	502
CUMHURİYET ÜNİ.	55	69	91	53	31	25	58	30	412
DİCLE ÜNİ.	59	75	87	37	31	23	37	30	379
DOKUZ EYLÜL ÜNİ.	52	78	101	60	47	54	90	10	492
DÜMLÜPINAR ÜNİ.	50	79	90	41	33	35	70	20	418
EGE ÜNİ.	57	74	100	86	55	35	55	10	472
ERCIYES ÜNİ.	62	86	96	53	42	53	74	30	496
FIRAT ÜNİ.	60	84	98	50	45	73	57	30	497
GALATASARAY ÜNİ.	54	84	110	58	53	61	67	30	517
GAZİ ÜNİ.	66	68	84	60	57	65	95	20	515
GAZİANTEP ÜNİ.	57	84	91	59	29	38	47	6	411



**Table A Structural Evaluation Report General Table (Cont.)**

HACETTEPE UNI.	74	74	114	65	70	79	97	10	583
HARRAN UNI.	38	54	39	32	18	23	28	0	232
INONU UNI.	59	55	100	20	35	10	35	0	314
ISTANBUL UNI.	69	75	95	33	35	39	40	20	406
ITU	79	75	106	50	95	66	80	30	580
IZMIR YUKSEK TEK. ENS.	39	70	85	25	38	45	25	20	347
KAFKAS UNI.	37	10	22	0	20	10	10	0	109
KATU	29	80	70	25	35	25	25	14	303
KOCAELI	69	70	108	50	75	95	50	20	537
M.KEMAL UNI.	14	68	104	20	50	20	30	0	306
MARAS UNI.	57	55	93	30	53	45	25	10	368
MARMARA UNI.	64	70	100	50	85	37	45	0	451
MERSIN UNI.	69	65	69	5	29	22	25	0	284
MIMAR SINAN UNI.	84	64	107	45	96	57	40	0	483
MUGLA UNI.	37	70	65	23	40	45	25	20	325
NIGDE UNI.	53	79	106	55	55	35	40	20	443
ODTU	84	75	105	65	85	75	60	60	599
ON DOKUZ MAYIS UNI.	70	73	111	85	59	52	40	0	490
PAMUKKALE UNI.	24	17	20	35	55	45	40	0	236
SAKARYA UNI.	57	78	114	18	75	25	45	15	425
SELCUK UNI.	14	57	93	48	23	20	35	30	320
SULEYMAN DEMIREL UNI.	64	82	105	51	65	89	75	12	544
TRAKYA UNI.	14	40	84	25	40	35	25	0	263
ULUDAG UNI.	54	75	102	25	55	50	40	10	411
YTU	27	57	118	26	80	55	60	20	433
YUZUNCU YIL UNI.	94	80	108	55	80	65	65	5	552
ZONGULDAK UNI.	50	72	84	25	20	21	27	20	319

**Table B Structural Evaluation Report Subtopic Table**

Security and Miscellaneous 2005/1		
Rank	Company	Value
1	ODTU	50
2	ANADOLU	40
3	BOGAZICI UNI.	40
4	CELAL BAYAR UNI.	40
5	CUKUROVA UNI.	30
6	CANAKKALE ONSEKIZ MART UNI.	30
7	CUMHURİYET UNI.	30
8	DICLE UNI.	30
9	AFYON KOCATEPE	30
10	ERCIYES UNI.	30
11	FIRAT UNI.	30
12	GALATASARAY UNI.	30
13	ITU	30
14	SELCUK UNI.	30
15	KOCAELI	20
16	MUGLA UNI.	20
17	NIGDE UNI.	20
18	YTU	20
19	ZONGULDAK UNI.	20
20	IZMIR YUKSEK TEK. ENS.	20
21	ISTANBUL UNI.	20
22	GAZI UNI.	20
23	GAZIOSMANPASA UNI.	20
24	GEBZE YUKSEK TEKNOLOJİ ENS.	20
25	ABANT İZZET BAYSAL	20
26	DUMLUPINAR UNI.	20
27	ADNAN MENDERES	15
28	SAKARYA UNI.	15
29	KATU	14
30	SULEYMAN DEMİREL UNI.	12

**Table B Structural Evaluation Report Subtopic Table (Cont.)**

31	ULUDAG UNI.	10
32	MARAS UNI.	10
33	HACETTEPE UNI.	10
34	EGE UNI.	10
35	AKDENİZ	10
36	ANKARA	10
37	ATATURK UNI.	10
38	BALIKESİR UNI.	10
39	DOKUZ EYLÜL UNI.	10
40	GAZİANTEP UNI.	6
41	YÜZÜNCÜ YIL UNI.	5
42	MARMARA UNI.	0
43	M.KEMAL UNI.	0
44	MERSİN UNI.	0
45	MİMAR SİNAN UNI.	0
46	TRAKYA UNI.	0
47	PAMUKKALE UNI.	0
48	ON DOKUZ MAYIS UNI.	0
49	HARRAN UNI.	0
50	İNÖNÜ UNI.	0
51	KAFKAS UNI.	0

**Table C Structural Evaluation Report Subtopic Company Table**

ODTU 2005/1 Navigation	
Menu structure is present	10 / 10
Vertical scrolling is minimized	5 / 10
Horizontal scrolling is minimized	15 / 15
All pages include standard navigation options (back, forward, main page)	15 / 15
Navigation options are consistent and standardized on all pages	10 / 10
Links are meaningful and relevant to the subject	10 / 10
Explanations available for link titles	5 / 10
Links are not broken	10 / 10
On main page, it is possible to judge how the web site is organized and what options are available	10 / 10
Icons clearly represent what is intended	0 / 10
Navigation is fast	10 / 10
Navigation options give an impression of a professional design	5 / 5
Total	105 / 125

**Table D Content Evaluation Report Sorted List Table**

Group	Interval
Top	34 - 42
Mid-Top	27 - 34
Middle	19 - 27
Mid-Bottom	11 - 19
Bottom	3 - 11

Content Evaluation For LIBRARY Period: 2005/1			
Rank	Company Name	Content	Group
1	<u>ODTU</u>	42	Top
2	<u>HACETTEPE UNI.</u>	34	Mid-Top
3	<u>EGE UNI.</u>	29	
4	<u>ANADOLU</u>	29	
5	<u>BALIKESIR UNI.</u>	27	
6	<u>MIMAR SINAN UNI.</u>	26	Middle
7	<u>CUKUROVA UNI.</u>	25	
8	<u>TRAKYA UNI.</u>	24	
9	<u>CANAKKALE ONSEKIZ MART UNI.</u>	23	
10	<u>ADNAN MENDERES</u>	23	
11	<u>CELAL BAYAR UNI.</u>	22	
12	<u>ERCIYES UNI.</u>	22	
13	<u>GAZI UNI.</u>	22	
14	<u>SULEYMAN DEMIREL UNI.</u>	22	
15	<u>YUZUNCU YIL UNI.</u>	22	
16	<u>MARMARA UNI.</u>	21	
17	<u>ITU</u>	21	
18	<u>INONU UNI.</u>	20	
19	<u>GEBZE YUKSEK TEKNOLOJİ ENS.</u>	19	
20	<u>DOKUZ EYLUL UNI.</u>	19	
21	<u>MARAS UNI.</u>	19	



**Table D Content Evaluation Report Sorted List Table (Cont.)**

22	<u>ON DOKUZ MAYIS UNI.</u>	18	Mid-Bottom
23	<u>AKDENİZ</u>	18	
24	<u>ABANT İZZET BAYSAL</u>	17	
25	<u>GAZİANTEP UNI.</u>	17	
26	<u>GALATASARAY UNI.</u>	17	
27	<u>ULUDAĞ UNI.</u>	17	
28	<u>YTÜ</u>	17	
29	<u>FIRAT UNI.</u>	16	
30	<u>İSTANBUL UNI.</u>	16	
31	<u>ATATÜRK UNI.</u>	16	
32	<u>GAZİOSMANPAŞA UNI.</u>	15	
33	<u>SAKARYA UNI.</u>	15	
34	<u>İZMİR YÜKSEK TEK. ENS.</u>	14	
35	<u>DÜMLÜPINAR UNI.</u>	13	
36	<u>CUMHURİYET UNI.</u>	13	
37	<u>BOĞAZICI UNI.</u>	13	
38	<u>M.KEMAL UNI.</u>	13	
39	<u>NİĞDE UNI.</u>	13	
40	<u>KOCAELİ</u>	12	
41	<u>ANKARA</u>	12	
42	<u>KATÜ</u>	12	
43	<u>AFYON KOCATEPE</u>	11	
44	<u>MUĞLA UNI.</u>	10	Bottom
45	<u>ZONGULDAK UNI.</u>	10	
46	<u>MERSİN UNI.</u>	9	
47	<u>SELÇUK UNI.</u>	9	
48	<u>DİCLE UNI.</u>	9	
49	<u>KAFKAS UNI.</u>	5	
50	<u>HARRAN UNI.</u>	5	
51	<u>PAMUKKALE UNI.</u>	3	

Table E Content Evaluation Report Content Comparison Table

	ANADOLU UNI.	EGE UNI.	BALIKESIR UNI.	CUKUROVA UNI.	CANAKKALE UNI.	ADNAN MENDERES	CELAL BAYAR UNI.	ERCİYES UNI.	DOKUZ EYLUL UNI.	AKDENİZ.	ABANT İZZET BAYSAL UNI.	GALATASARAY UNI.	FIRAT UNI.	ATATÜRK UNI.	DÜMLÜPINAR UNI.	CUMHURİYET UNI.	BOGAZICI UNI.	ANKARA UNI.	AFYON KOCATEPE UNI.	DİCLE UNI.	TOTAL %
about library building		1		1	1	1	1	1	1	1	1			1	1					1	45
ask a librarian		1		1	1				1	1											30
borrowing & circulation rules	1	1	1	1	1	1	1	1	1	1			1	1			1	1	1		70
catalog search	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		95
comments & suggestions		1		1	1		1			1	1	1	1				1			1	45
computing facilities				1				1			1		1								20
document delivery service	1	1	1	1		1					1	1									30
e-books search	1	1	1	1	1	1	1	1	1			1	1				1	1			60
e-journals search	1	1	1	1	1	1	1	1	1	1		1	1		1		1	1	1		85
e-references search	1		1	1	1	1			1	1				1	1	1	1			1	60
e-thesis search	1		1	1		1	1		1	1					1			1			45
faq	1	1	1					1													20
floor plans	1							1			1			1			1				25
hold												1									5
how to reach	1											1					1				10
info about donations to library			1	1	1	1	1					1	1								35
info about user trainings	1	1	1	1	1	1	1				1				1						50
info on off-campus access to ematerial	1								1	1											15
interlibrary loan	1	1	1	1	1		1	1			1	1		1		1			1		60
job application		1																			5
library account	1	1											1								15
library collections	1	1	1	1		1		1	1	1	1				1		1	1		1	65
library departments	1	1	1			1		1			1			1			1				40

Table E Content Evaluation Report Content Comparison Table (Cont.)

library history	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	65
library homepage link	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	85
library mission and vision statement				1	1	1									1			20
library of congress classification system	1																	5
library rules	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	90
library staff	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	95
library working hours	1	1	1	1	1	1		1	1	1	1	1	1	1				60
links to other related sources	1	1	1	1	1	1	1	1	1		1				1		1	60
memberships	1		1	1	1	1	1				1							40
new arrivals	1		1	1	1				1	1	1							45
news	1	1	1	1		1	1	1	1	1	1	1	1	1	1			75
online databases/indexes	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100
photocopying facilities		1	1	1	1	1		1									1	30
recommend a book		1	1		1										1			20
renew		1									1							10
search	1	1	1		1	1	1	1	1					1				40
site map							1										1	10
university homepage link	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	75
virtual tour in library building	1							1	1									15