Web Vulnerability Detection and Security Mechanism

Katkar Anjali S., Kulkarni Raj B.

ABSTRACT– Web applications consist of several different and interacting technologies. These interactions between different technologies can cause vast security problems. As organizations are taking their businesses online they make their systems accessible to the world. They might have a firewall in place and possibly even their web server is running an up-to-date version of its software but that is not enough to protect their resources.

The research areas of this paper outline the major publicly reported security vulnerability in recent year's strong growth of the web applications. Unvalidated Input, Broken Access Control, Broken Authentication and Sessions Management, Insecure Configuration Management, Improper Error Handling, Parameter Modification, Cookie Modification and Directory Traversal have been the most dominant class of web vulnerabilities. Further, the research includes methods for detecting the vulnerabilities and then providing security mechanism to protect web application from those vulnerabilities.

The result shows the security mechanisms against the attacks and vulnerabilities. Securing the websites against these vulnerabilities is very difficult and challenging task as day to day new techniques for attacks are invented, so the study of various types of vulnerabilities, detecting the attacks and providing solution for these vulnerabilities is essential part in internet world.

KEYWORDS- Security, Vulnerability detection and Web applications.

I. INTRODUCTION

The World Wide Web, have become one of the most common communication mediums in the World. Millions of users connect every day to different web-based applications to search for information, exchange messages, interact with each other, conduct business, perform financial operations and many more. Some of these critical web-based services are targeted by several malicious users intending to exploit possible vulnerabilities, which could cause not only thedisruption of the service, but also compromise the users and organizations information.

Most of the times, these malicious users succeed in exploiting different types of vulnerabilities and the consequences can be disastrous.

A. Literature Review

According to Johari, R.;Sharma, P., In the article "A Survey on Web Application Vulnerabilities (SQLIA, XSS) Exploitation and Security Engine for SQL Injection", main objective of this paper is only on the study of various types of Structured Query Language Injection attacks and Cross Site Scripting vulnerabilities and their security techniques. They proposed to future study on Structured Query Language Injection attacks.

Silic, Marin;Krolo, Jakov; Delac,Goran states in their article "Security vulnerabilities in modern web browser architecture". Studied various web browser architecture, as browser is the main source of vulnerability. Further, discussed on the various newweb browser vulnerabilities, assess the web browsers architecture and how they response in web security problems.

According to Fonseca J., Vieira, M.;Madeira, H. "Testing and Comparing Web Vulnerability Scanning Tools for SQL Injection and XSS Attacks".On web application automatic vulnerability scanner are used to identify vulnerabilities. Main Objective of this paper is on study of XSS and SOL injection vulnerabilities, methods to detect and apply benchmark automatic scanners to detect software fault injection techniques.

Vieira, M.; Antunes, N.; Madeira, H.intheir article **"**Using web security scanners to detect vulnerabilities in web services**"**detailed studied on various available scanners in the market to scan the vulnerabilitiesin the web application and compare their performance which will be suitable to apply on web services.

After the review of various researcheson web vulnerabilities and security, focused mainly on the survey, scanner, different tools, various tester and detectors of vulnerabilities but not emphases on the prevention techniques to protect against vulnerabilities. The research area of this paper is focused not only on the study of various vulnerabilities such as Unvalidated Input, Broken access control, Broken Authentication and Sessions management, Insecure Configuration Management, Improper Error Handling, parameter modification, cookie modification and directory traversal. But also the methods on how to detect and provide security mechanism to protect the web applications.

We build a Blog website and demonstrate both secured and insecure version of the website. We demonstrate the attacks through Black box testing of each vulnerability.

Our main objective is to find out whether these security mechanisms provide significant help to the builder of a web application. That is, help in reducing the potential security risk of running the application. Secondarily we will assess the level of security expertise needed to gain benefit from these security mechanism. Our scope, however, is limited to qualitative aspects of the products. Any performance issues are out of the scope of this paper.

Intended audience of the paper are web application designers, testers and architects, system administrators responsible for maintaining web applications, security professionals and academics.

The scope of this paper is limited to study the various vulnerabilities and the technic of assessing the vulnerability in web application and providing the protection according to their

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approach to webapplication. Thus, we will not test the performance of security on the web application. When possible, however, we will provide the security to help better understand their approach.

The rest of the paper is organized as follows. Section II discusses security vulnerabilities found in web applications and the current methods for analyzingvulnerabilities of web application. In section III we will evaluate security mechanism available for web applicationsecurity assessment. In sectionIV represents the result analysis of the objective of research paper. In section Vwe will draw our conclusions of the study of web vulnerabilities and security mechanism.

II. VULNEARABILITIES FOUND IN WEB APPLICATION

In this section we will discuss the various vulnerabilities mostly independent of the underlying platform and which are commonly found in commercial sites even though these vulnerabilities have been publicly known for some time now. Commonly web servers, application servers, and web application environments are susceptible to following types of vulnerabilities.

UnvalidatedInput

Web application request inputs from user to determine how to respond in accordance to provide web service. The user enters input values to web application request. Attackers may pass harmful information to the web application which tries to bypass the website’s security mechanisms.

Broken Access Control

In web application the users are categorized in the different level of privileges. Access control determines how the web application allows access to functions to some users and not others, also called authorization. But attacker may be access higher level of authority.

Broken Authentication and Sessions Management

Web application creates session when the user logged in, which specify the period of time that a unique user interacts with a web application. Using session maintains state by providing the client with a unique id. This id is stored in a cookie which is used between the user browser and web server. If this session’s details are not protected correctly, attacker can steal it and misuse it.

Improper Error Handling

In the web application when error occurs under normal transactions and if not handled by proper error message to the user then there is chances of getting clues on flaws about the web application to the attackers and may disturb to the normal user.

Parameter Modification

Parameter modification is the problem where the attacker’s do not fill the form but rather passes the parameters from URL itself, bypassing the form validations. Therefore it may lead to ambiguous effect on the form data and the overall site data.

Insecure Configuration Management

The web server that hosts the web application consists of web configuration files and directories which should not be accessed or view by someone unauthorized. So must be protected against the attackers.

Cookie Modification

Cookie stores the information in the text format which is used for state management. The web application uses cookies; the server sends cookie and stores at client browser. The browser then returns the cookie to the server the next time the page is requested.The attackers can easily connect with the server to modify the contents of user’s cookie.

Directory Traversal

Web server consist of directories where files, information, application functions are stored to provide the services which does not have access to users. But attackers obtain these unauthorized directories, by traversing the directory in the address area of web browser and may misuse it.

B. Vulnerability Detection

In this section we examine the techniques to findout vulnerabilities present in the web application.

UnvalidatedInput

All user input that provided to the web applications requested, need to check by against strict format that specifies exactly what input must be allowed. Ensure that all parameters are validated before they are used. A tool or library is most effective, as the performing the checking should be placed.

Broken Access Control

The code implementation of the access control policy should be verified. Penetration testing can be useful in verifying if there are problems in the access control.In the web application, if there is categories of users that can be accessed through the interface, verify each interface to make sure that only authorized users can allowed access.

Broken Authentication and Sessions Management

Detailed review of authentication mechanisms to ensure that user's credentials are protected and only an authorized user can change them. Review your session management mechanism, that session identifiers are always protected.

Improper Error Handling

Error handling should be consistently focus on the entire application. A code review will reveal how the system is intended to handle various types of errors.Simple testing can determine how your site responds to various kinds of input errors.

Parameter Modification

Ensure that application must not allow parameter values, query string or form GET parameters to the URL. These are handled through dynamic parameter detection.

Insecure Configuration Management

Web server configuration files must not be accessed by the user, unauthorized files and directories permissions, Server software flaws or misconfigurations that permit directory listing and directory traversal attacks, some of these problems can be detected by scanning.

III. SECURITY MECHANISM

This section lists security mechanism to provide protection against attacks and vulnerabilities that a web application should be prepared for.

Unvalidated Input

All the input parameters to the web application should be validated against specification such as use of data type, length of all fields, whether null, duplicates are allowed, parameter is required or not, numeric range, specific legal values (enumeration), patterns (regular expressions). Parameter validation services must be configured with definition of what is valid for each parameter for web application. This includes properly protecting all types of input from web application request, including URLs, forms, query strings and parameters.

Broken Access Control

Attackers will use path traversal method,which providepath informationas part of a request for information. Such attacks may try to access files that are normally not directly accessible. Such attacks can be submitted in URLs as well as any other input that ultimately accesses a file.In such case redirect the page to custom error page message.

Broken Authentication and Sessions Management

Ensuring that implementation consistently enforces to have a secure authentication and session management mechanism which include:passwords should have restrictions that require a minimum size; securing session id, a user's entire session should be protected; browser cache protection, authentication and session information never submitted as part of a GET parameter. Authentication pages must be specified withno cache tag to protectfrom using the back button in a user's browser; session tokens should be expired on the server, and destroyed when a browser is closed; Everywhere authenticate must be provided.

Improper Error Handling

In the implementation, ensure that the site is built to handle all possible errors. When errors occur, the application should inform the user with proper error message without unnecessary internal details. Provide the user with diagnostic information (e.g., validation errors), but do not provide developer level diagnostic/debug information.Limit error messages regarding user ID and password errors; do not describe the password complexity.

Parameter Modification

In this type of vulnerability attacker involves providing the input parameter in the URL of the web application in such case don't allow the URL as for example "………..../User Login Page? Username = xyz & password =xyz123".In such case redirect the page to custom error page message.

Insecure Configuration Management

Develop a configuration tool; protect the web server's configuration files from user to access. The configuration process should include: protecting all security mechanisms from unauthorized user; remove the unused services from web application; provide the access rights(privileges) as roles, permissions, and accounts, including disabling all default accounts or changing the passwords option, logging options and various alerts.

Cookie Modification

Cookies are destroyed at the point the user closes the browser and unless a deletion date has been set. If the user closes the browser without sign out then default deletion date has been set, the cookie will be destroyed on that deletion date instead.

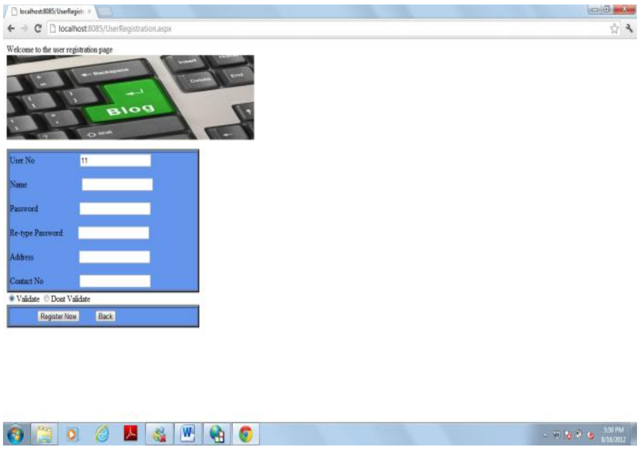
Directory traversal

Ensure you have installed the latest version of your web server software. In the web server don't allow anyone to access the root directory or any other configuration files as only administrators can maintain access control list and whether a file can be viewed or executed by users, as well as other access rights. Also don't allow attackers to access files from root directory by using the address bar of web browser.

IV. RESULT ANALYSIS

Unvalidated Input

Any input web applications acceptmust be checked against a strict format that specifies exactly what input will be allowed.(Fig1)



localhost:8085/UserRegistration.aspx

Welcome to the user registration page

User No: 11
Name:
Password:
Re-type Password:
Address:
Contact No:

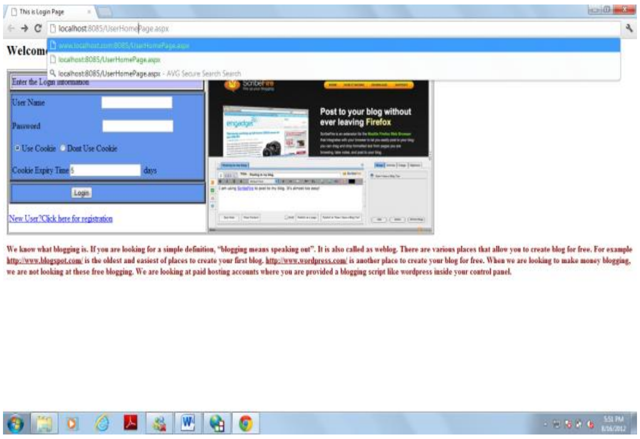
● Validate ○ Dont Validate

Fig1: Unavalidated Input

Broken Access Control

Attacker may try to access the unauthenticated page directly by passing the inaccessible URL,in such case redirect the page to custom error page message.

(Fig 2 and 3)



This is Login Page

localhost:8085/UserHomePage.aspx

www.localhost.com:8085/UserHomePage.aspx
localhost:8085/UserHomePage.aspx
localhost:8085/UserHomePage.aspx - AVG Secure Search Search

Welcom

Enter the Login information

User Name:
Password:

● Use Cookie ○ Dont Use Cookie

Cookie Expiry Time 5 days

New User?Click here for registration

We know what blogging is. If you are looking for a simple definition, "blogging means speaking out". It is also called as weblog. There are various places that allow you to create blog for free. For example http://www.blogspot.com/ is the oldest and easiest of places to create your first blog. http://www.wordpress.com/ is another place to create your blog for free. When we are looking to make money blogging, we are not looking at these free blogging. We are looking at paid hosting accounts where you are provided a blogging script like wordpress inside your control panel.

Fig2: Broken Access Control

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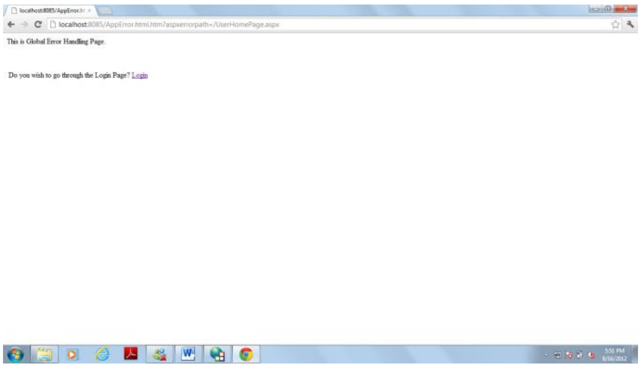


This is Global Error Handling Page.

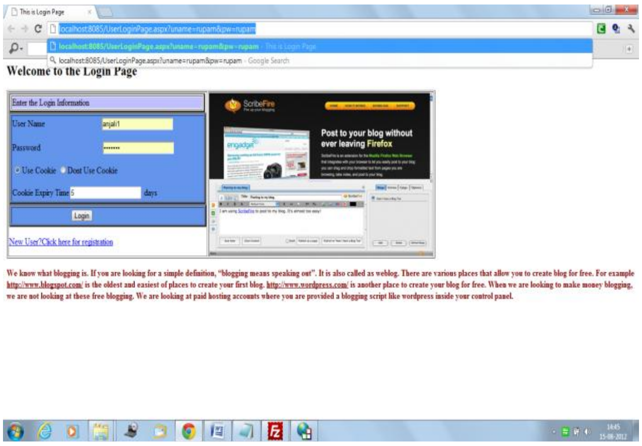
Do you wish to go through the Login Page? Login

Fig3: Broken Access control (Custom Error page is displayed)

Parameter Modification

In this vulnerability, attacker tries to pass parameter in the URL of web application such as "http://........./UserLoginPage.aspx?username=xyz&password = xyz123"

Which don't allow attacker to login and redirect the attacker to custom error page. (Fig4)



localhost:8085/UserLoginPage.aspx?uname=rupam&pw=rupam

Welcome to the Login Page

Enter the Login Information

User Name anjali1

Password ●●●●●●●

● Use Cookie ○ Dont Use Cookie

Cookie Expiry Time 5 days

Login

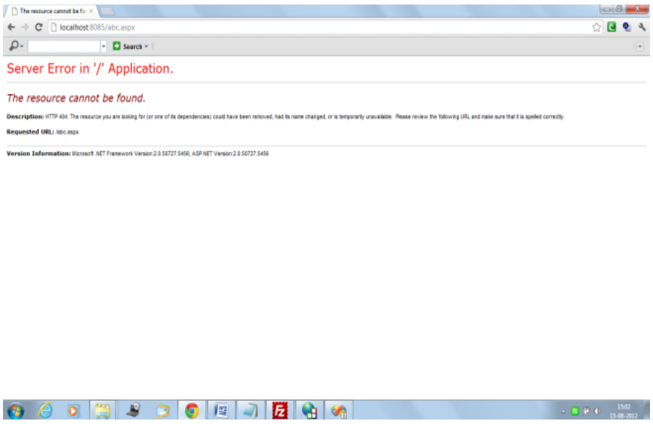
New User?Click here for registration

We know what blogging is. If you are looking for a simple definition, "blogging means speaking out". It is also called as weblog. There are various places that allow you to create blog for free. For example http://www.blogspot.com/ is the oldest and easiest of places to create your first blog. http://www.wordpress.com/ is another place to create your blog for free. When we are looking to make money blogging, we are not looking at these free blogging. We are looking at paid hosting accounts where you are provided a blogging script like wordpress inside your control panel.

Fig4: Parameter Modification

Improper Error Handling

When errors occur, the site should respond with a specifically designed result that is helpful to the user without revealing unnecessary internal details. So if attacker passes the not existent URL, instead of displaying browser error message, it will redirect to custom error page.(Fig5 and 6)



localhost:8085/abc.aspx

Server Error in '/' Application.

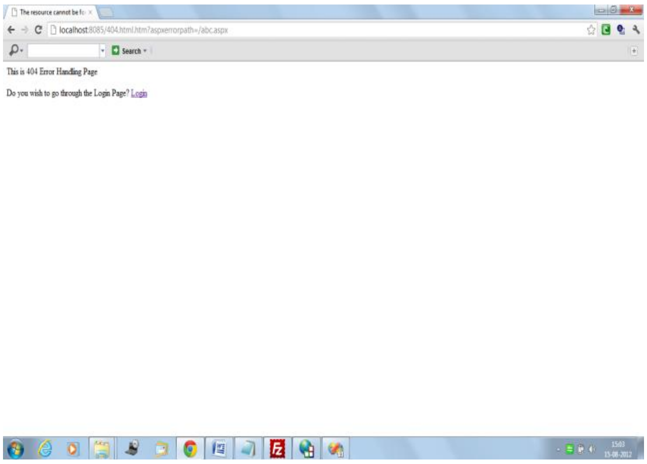
The resource cannot be found.

Description: HTTP 404. The resource you are looking for (or one of its dependencies) could have been removed, had its name changed, or is temporarily unavailable. Please review the following URL and make sure that it is spelled correctly.

Requested URL: /abc.aspx

Version Information: Microsoft .NET Framework Version:2.0.50727.5456; ASP.NET Version:2.0.50727.5456

Fig5: Improper Error Handling



localhost:8085/404.html.htm?aspxerrorpath=/abc.aspx

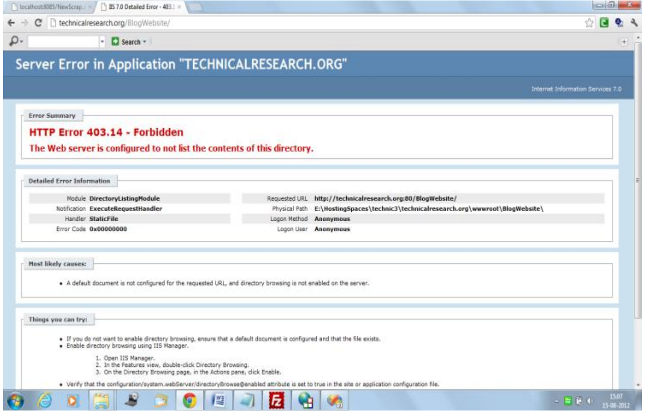
This is 404 Error Handling Page

Do you wish to go through the Login Page? Login

Fig6: Improper Error Handling (Custom Error page is displayed)

Directory Traversal

The root directory prevents attackers from accessing files, also the files residing outside of the root directory. If attacker tries to usehttp://........./ BlogWebsite**,** (For Example "BlogWebsite" is root directory) it will not enlist the files or directory of root directory.(Fig 7)



technicalresearch.org/BlogWebsite/

Server Error in Application "TECHNICALRESEARCH.ORG"

Internet Information Services 7.0

Error Summary

HTTP Error 403.14 - Forbidden

The Web server is configured to not list the contents of this directory.

Detailed Error Information

Module	DirectoryListingModule	Requested URL	http://technicalresearch.org:80/BlogWebsite/
Notification	ExecuteRequestHandler	Physical Path	E:\HostingSpaces\technic3\technicalresearch.org\wwwroot\BlogWebsite\
Handler	StaticFile	Logon Method	Anonymous
Error Code	0x00000000	Logon User	Anonymous

Most likely causes:

- A default document is not configured for the requested URL, and directory browsing is not enabled on the server.

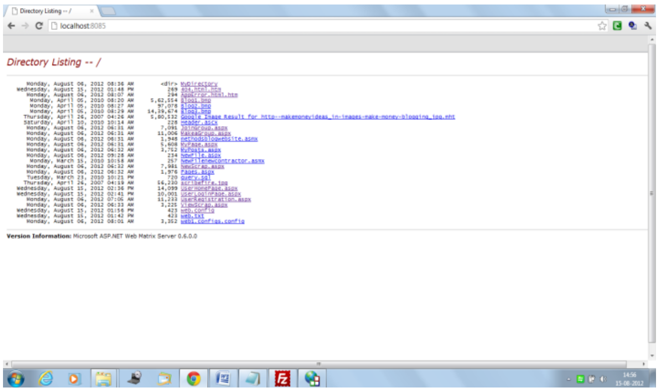
Things you can try:

- If you do not want to enable directory browsing, ensure that a default document is configured and that the file exists.
- Enable directory browsing using IIS Manager.
  1. Open IIS Manager.
  2. In the Features view, double-click Directory Browsing.
  3. On the Directory Browsing page, in the Actions pane, click Enable.
- Verify that the configuration/system.webServer/directoryBrowse@enabled attribute is set to true in the site or application configuration file.

Fig7: Directory Traversal

Insecure Configuration Management

In this vulnerability, even if we try to access root directory locally,it will enlist all the files and directories.Clickon any file like a bmp file or text files, it will be displayed. But on click of"web.config" access isdenied. As the security is provided on configuration file of web application.(Fig 8)



localhost:8085

Directory Listing -- /

```
   Monday, August 06, 2012 08:36 AM        <dir> MyDirectory
Wednesday, August 15, 2012 01:48 PM          269 404.html.htm
   Monday, August 06, 2012 08:07 AM          294 AppError.html.htm
   Monday, April 05, 2010 08:20 AM      5,62,554 Blog1.bmp
   Monday, April 05, 2010 08:27 AM        97,078 Blog2.bmp
   Monday, April 05, 2010 08:29 AM     14,39,674 Blog3.bmp
 Thursday, April 26, 2007 04:26 AM      5,80,532 Google Image Result for http--makemoneyideas_in-images-make-money-blogging_jpg.mht
 Saturday, April 10, 2010 10:14 AM           228 Header.ascx
   Monday, August 06, 2012 06:31 AM        7,091 JoinGroup.aspx
   Monday, August 06, 2012 06:31 AM       11,006 MakeaGroup.aspx
   Monday, August 06, 2012 06:31 AM        1,948 methodsblogwebsite.asmx
   Monday, August 06, 2012 06:31 AM        5,608 MyPage.aspx
   Monday, August 06, 2012 06:32 AM        3,752 MyPosts.aspx
   Monday, August 06, 2012 09:28 AM          234 NewFile.aspx
   Monday, March 15, 2010 10:58 AM           257 NewFilenewcontractor.asmx
   Monday, August 06, 2012 06:32 AM        7,981 NewScrap.aspx
   Monday, August 06, 2012 06:32 AM        1,976 Pages.aspx
  Tuesday, March 23, 2010 10:21 PM           720 query.sql
 Thursday, April 26, 2007 04:19 AM        56,230 scribefire.jpg
Wednesday, August 15, 2012 02:36 PM       14,099 UserHomePage.aspx
Wednesday, August 15, 2012 02:41 PM       10,001 UserLoginPage.aspx
   Monday, August 06, 2012 07:06 AM       11,233 UserRegistration.aspx
   Monday, August 06, 2012 06:33 AM        3,225 ViewScrap.aspx
Wednesday, August 15, 2012 01:56 PM          423 web.config
Wednesday, August 15, 2012 01:42 PM          423 web.txt
   Monday, August 06, 2012 08:01 AM        3,352 web1.configs.config
```

Version Information: Microsoft ASP.NET Web Matrix Server 0.6.0.0

Fig8: Insecure Configuration Management

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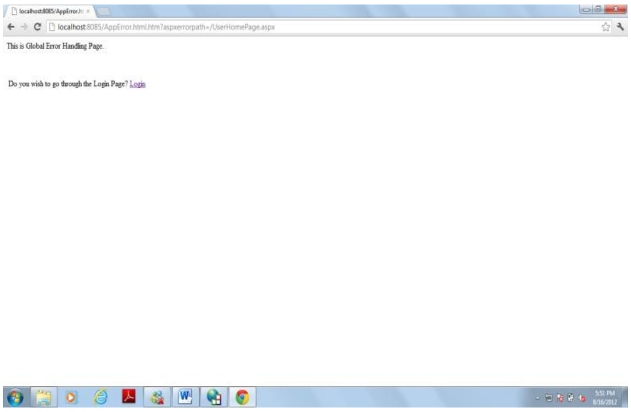
Session Management

If session handling is not provided, then if open the login page,fill the form and hit login. You can see error is generated. This means without session, the system will not permit to access the site.(Fig 9)



localhost:8085/AppError.html.htm?aspxerrorpath=/UserHomePage.aspx

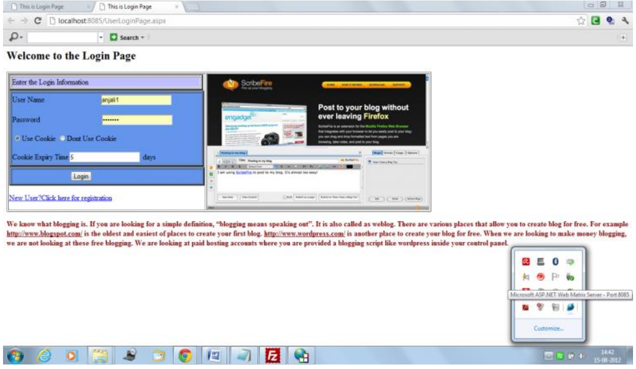
This is Global Error Handling Page.

Do you wish to go through the Login Page? Login

Fig9: Session Management

Cookie Modification

Cookies are destroyed at the point the user closes the browser and unless a deletion date has been set. If the user closes the browser without sign out then default deletion date has been set, the cookie will be destroyed on that deletion date instead.(Fig 10)



localhost:8085/UserLoginPage.aspx

Welcome to the Login Page

Enter the Login Information

User Name: anjali1

Password: ••••••••

● Use Cookie ○ Dont Use Cookie

Cookie Expiry Time 5 days

Login

New User?Click here for registration

We know what blogging is. If you are looking for a simple definition, "blogging means speaking out". It is also called as weblog. There are various places that allow you to create blog for free. For example http://www.blogspot.com/ is the oldest and easiest of places to create your first blog. http://www.wordpress.com/ is another place to create your blog for free. When we are looking to make money blogging, we are not looking at these free blogging. We are looking at paid hosting accounts where you are provided a blogging script like wordpress inside your control panel.

ScribeFire
Post to your blog without ever leaving Firefox
Microsoft ASP.NET Web Matrix Server - Port 8085
Customize...
14:42
15-08-2012

Fig10: Cookie Modification

V. CONCLUSION

There are several website security issues. These issues are common to various types of websites, irrespective of the type of website development language and technology. Analyzing the threats and how that can affect the data and the site itself is an important aspect of web development. Though several techniques and extensions exists in virtually all the technologies, no work presents an interface where both secured and insecure version of the site can be checked.

Therefore in this work we presented a novel technique to demonstrate the web vulnerabilities through live site and prove that simple configuration and coding changes can ensured highly secured website. Hence we studied various vulnerabilities like Unvalidated Input, Broken Access Control, Broken Authentication and Sessions Management, Insecure Configuration Management, Improper Error Handling, Parameter Modification, Cookie Modification and Directory Traversal. Also methods for detecting those vulnerabilities and successfully implemented security mechanism to all those vulnerabilities to provide protection.

The work can be further improved by demonstrating the other various vulnerabilities like SQL injection, Cross Site Scripting, Buffer Overflow, Daniel of Service and providing solution for the same.The objective of this paper is only a starting point for those issues that represent the most serious risks to web application security.

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Katkar Anjali S. received her B.E. Degree in Computer Science and Engineering from Walchand Institute of Technology, Shivaji University. She has worked as Lecturer for four years undertaken subjects are Core Java, J2EE and Visual Basics in Computer Technology Department. She is pursuing M.E degree in Computer Science and Engineering from Walchand Institute Of Technology, Sholapur, Maharashtra, INDIA. Her research interest includes web development, web security, web application attacks and its defense.

Kulkarni **Raj B.** is working as Professor in Computer Science and Engineering Department., Walchand Institute of Technology, Sholapur, Maharashtra, INDIA. He is pursuing Ph.D. in Computer Science and Engineering and has published international journal, National journal, international conference and national conference to his credit. He has taught various subjects such as , Network Engineering, Operating System part I and II, Data warehouse and Data mining, Web Technology etc. at Graduate and Post Graduate Level. He has guided several projects at graduate and post graduate level.