

L Collins - Web Report

by Lauren Paige Collins

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MSc Applied Computing

Web Technologies for eCommerce

**Interactive Website using a range of Web
Technologies**

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1.0 Introduction

Accompanying this report, will be an information-based website which will be produced using appropriate client-side scripting techniques. Data is going to be created and stored in tables within a controlled database, where the data can be entered, modified or erased. Many techniques are going to be adapted into this design to ensure the required website is developed efficiently and correctly to meet the requirements that supports dynamic content.

This report will be highlighting the issues that need to be considered when creating a website for public usage. This will include issues which have arisen from the development and completion of the website and other features which need to be adapted if the website was to be released. Explanations for choice of code that was used to implement security measures, will also be discussed.

2.0 Security

When working on a computer, security measures always need to be implemented. The same also applies to websites. If this website was to become live to be used by real users, security would be an important issue. Garfinkel has given this simple definition of computer security, "A computer is secure if you can depend on it and its software to behave as you expect". [1]

Usually when a website is described as secure, often SSL (Secure Socket Layer) has been applied and it is encrypted. However, encryption does not ensure the security of the website as only stops hackers from viewing what a user is doing, but if important vulnerable data is being transferred, this could still be hacked and stolen by an attacker. "Web security, then, is a set of procedures, practices and technologies for assuring the reliable, predictable operation of web servers, browsers, other programs that communicate with web servers, and the surrounding internet infrastructure". [1] One of the most common issues found, is that websites have not been correctly backed up, which could cause a loss in vital data. Ensuring that multiple copies of the website are created, stored in separate places and are regularly updated gives peace of mind to the business, if issues were to arise. [2]

There are three primary aspects that should be considered when discussing web security: -

- ❖ Securing the web server and the data that is on it.
- ❖ Securing information that travels between the web server and the user
- ❖ Securing the end user's computer and other devices that people use to access the internet. [1]

2.1 Security Measures to Apply

Some people believe that data on a website is not worthy to be attacked by hackers but so many websites are compromised daily. Often when security breaches take place, attempts are made to use the websites sever for spam emails or set up a provisional server to distribute illegal files. Below are nine suggestions to aid with protecting a website.

1. Keep software up to data
2. Watch out for SQL injection
3. Protect against XSS(Cross Site Scripting) attacks
4. Beware of error messages
5. Validate on both sides
6. Check your passwords
7. Avoid file uploads
8. Use HTTPS
9. Get website security tools [3]

2.2 Security Code Applied

SQL injection is a common threat within websites, similar to the site which has been produced to accompany this report. Fortunately, there is code which can be implemented to prevent this. Examples of the SQL injection can be viewed below.

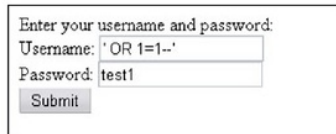


Figure 1.

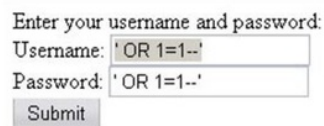


Figure 2.

One way of doing this, which has been applied to the website is writing prepared statements. This can also be applied for the use of multiple variables and inserting records within a website.

In the below figure, the prepared statement has been pre-written to allow for understanding of what it entails and how it works.

Here's the full code:

```
<?include "conninfo.php";

$search=$_POST["surname"];

$query="SELECT * FROM people WHERE surname like ?";

$stmt = mysqli_stmt_init($link); //link to database
mysqli_stmt_prepare($stmt, $query); //prepare query

mysqli_stmt_bind_param($stmt, "s", $search); //attach parameter to query
// (type, variable name)

mysqli_stmt_execute($stmt); //execute query

$result = mysqli_stmt_get_result($stmt); //get results

while ($r = mysqli_fetch_array($result)) //print as normal
{
    echo $r["firstname"]. " ";
    echo $r["surname"]. "<br>";
}

mysqli_stmt_close($stmt);
mysqli_close($link);?>
```

Figure 3.

Not only does applying this code prevent the SQL injection but can also be extremely useful when variables are within queries, as it adapts special characters e.g. punctuation, into the appropriate text required. This then allows for the information to be displayed correctly on the website.

By replacing the variables where required and fixing the parameters, the query can be implemented correctly creating an improved security on the code and the data.

3.0 Scalability

"In technical terms, scalability is defined as the potential of a system, network, or even a process to handle a certain number of simultaneous users, sessions, transactions, or operations and grow seamlessly as needed". [4]

As a website expands, it is essential that it can comprehend the number of users and also how it is being used. An example of this is, "Facebook launched in February, 2004. By the end of that year, it had about one million users. By June, 2016, the number of monthly users averaged 1.7 billion. And users expect their walls and profile pages to load quickly; they expect to be able to read and write seamlessly". [5] During that time, Facebook had the duty of ensuring that its website was able to handle such a large amount of users, which is why this can be so important to the running of a website.

3.1 Aspects of a Scalable Website

Below are seven key aspects [4] and explanations that should be considered, within the scalability of a website.

❖ Reliability

One important feature for a successful website, is for it to be reliable. If performs as it should for a specific period and withholds failure, it defines the systems resistance. However, if a system does partially fail, it should not lead to the whole system shutting down. There are two different measures to test and calculate the reliability of a website. These are: -

1. Mean Time Between Failures (MTBF): This is defined as the difference of Total Time Elapsed and Total Downtime divided by the number of failures.
$$MTBF = \frac{\text{Total Time Elapsed} - \text{Total Downtime}}{\text{Number of failures}}$$
2. Mean Time to Repair (MTTR): This is defined as the average time taken to repair a failed component.

Figure 4.

❖ Performance

This can often be misinterpreted for the time taken to complete a task within a website, but performance is the task amount that is completed related to the time and resources which are used to achieve it.

❖ Responsiveness

The responsiveness of a website is the time taken between procedures. For live websites this is often linked with performance. Although this is a key aspect to measure, it is equally vital to contemplate the resources being used at the time.

❖ Availability

This refers to the capability of a user being able to access the website at a time when it is thought to be available, as it is assumed that most websites are available 24/7. Availability often associations with responsiveness due to, if the response time of the site is excessively delayed, it will be perceived as inaccessible. The below formula can be used to calculate the availability of a website.

$$\text{Availability (\%)} = (\text{Total Time Elapsed} - \text{Total Downtime}) / (\text{Total Time Elapsed})$$

Figure 5.

When a website is not available for viewing or use, a message is usually displayed explaining that the website is temporarily unavailable. An example of this can be seen below for the popular search engine, Google.

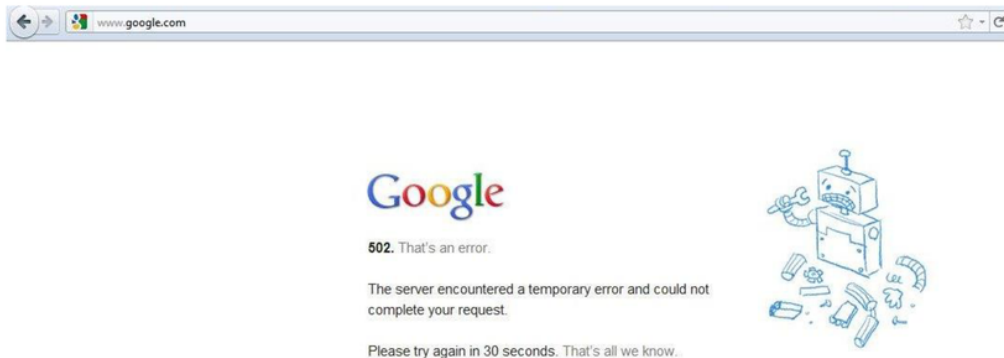


Figure 6.

❖ **Single Points of Failure**

Within websites, it is ideal to have more than one web server and database. If there is only one of each and one fails, the site either will overall collapse or only present some data which will class it as partially failed. As a result of this, both the server and database are classed as Single Points of Failures (SPOFs).

❖ **Fault Tolerance**

Fault tolerance is an important feature for a website. It is important that a website does not completely fail after certain specific components collapse, this then defines the system as fault tolerant. It is essential to balance the traffic if this was to happen. This should then result in a typical user not noticing a difference when the websites being used.

❖ **Downtime impact**

The downtime of the server, facility or a resource is when this is considered. The ways to measure the impact of this, is to focus on the users that were affected, apparent business loss, and damage of status. Of course, it is important to aim to avoid any issues surrounding this, as it could result in a permanent loss in users or customers due to the users feeling insecure using the website.

4.0 Usability

Usability is a vital component to consider when creating a website. "Web site usability is not just about making sure everything on the site works, but how quickly and easily visitors are able to make use of the site". [6]

Often a website is the only point of contact that a user has with a company. As a result of this, companies often fully rely on a web presence to solely achieve the businesses aims and objectives.

What makes a website usable "largely depends on the nature of the web site and the company's goals, it is generally acknowledged that web sites which provide the user with useful, well organised, navigable information in a well-structured layout are likely to retain users who access them and also generate repeat visitors". [7]

4.1 Strategies to achieve Usability

There are many strategies that can be put in place, to ensure that a website is useable and meets the requirements of a variety of users. Below are seven strategies [8] which could be applied to achieve this.

❖ Good User Interface

Regardless of the type of website that is being built, the target audience should be the main focus when creating it. In addition to this, the webpage will appear differently depending on the device and web browser that is used to load the website. If not build correctly to meet the users needs, this could discourage people from viewing and using the site.

❖ Navigation Usability

Along with user interface, if the navigation of the site is poor it will receive less visitors. It can be useful to create site map to view where is best to place the navigation elements of the site, based on its content. It is important to again to keep the users as the focus, because no matter how the programmer or designer view the site, the potential users will view it differently

❖ Search Functionality

Although this is not often seen as a key factor in usability, it can have a sizable difference on the website. Users of a website tend to use the search bar if they are unable to locate certain information or a product. Because of this, search functionality should not be underrated.

❖ **Content Usability**

A common issue on websites can be that the content and images have not been balanced correctly to meet the requirements of the target audience. Appropriate content and images that are viable and relate to the purpose of site, it increases the users trust and encourages more visits. Along with appropriate and correct content, validation should be in place for when users are inputting their own information, e.g. creating a user account. Having this in place will inform the user if they missed a field that requires data to allow for creating the account.

❖ **Images to Support Content**

This strategy links with the point above but images do play an important role. Images support content and grasp the attention when users scan through a page. This encourages the end user to stay on the webpage for a longer period.

❖ **Videos to Enhance Content**

"Users typically spend between 10 and 20 seconds on a web page unless the content grabs their attention" [8], as mentioned in the previous point. Videos are a good tool to use to highlight certain content.

❖ **Fast Loading Web Pages**

Linking with the time period people use websites for, users will leave a webpage quicker if the website does not load in appropriate time frame. Tools can be used to test how rapidly the website loads. If this can be improved it is important to do so, because people tend to not like to wait slow loading websites.

5.0 Accessibility

“Like usability, accessibility is a quality – in this case, it means how easily and effectively a product or service can be accessed and used. Good accessibility is designed for the full range of capabilities, as well as for the context of use or environmental constraints”. [9] Depending on the user, accessibility of a website is key aspect that the end user will notice.

If a user has disability, the internet often removes barriers of communication and if a website is poorly designed, this may unintentionally exclude some users from using the website. Web accessibility includes all disabilities which could affect end users from accessing websites. These include, but not limited to: -

- ❖ “Auditory
- ❖ Cognitive
- ❖ Neurological
- ❖ Physical
- ❖ Speech
- ❖ Visual” [10]

Although accessibility isn't an aspect that is always first thought of by website programmers and developers, accessibility also influences the users who do not have disabilities. One of the most popular examples is, that not everyone uses the internet on home computers now. The internet is often more commonly used on smaller devices, e.g. mobile phones, tablets, laptops, smart watches etc.

The population of these devices grows every day and, it is important for any business who has a web presence to apply accessibility. “W3C notes that, accessibility overlaps with other best practices such as mobile web design, device independence, multi-modal interaction, usability, design for older users, and search engine optimization (SEO)”. [11] Not doing this could result in a loss of people using the site which no business would want to happen.

5.1 Guidelines to achieve Accessibility

The following guidelines can be applied to ensure that the website is made more accessible for the variety of users who could visit and use the webpage.

1. “Make sure the site is keyboard-friendly
2. Ensure all content is easily accessible
3. Add alt text to all images
4. Choose colours carefully
5. Use headers to structure content
6. Design forms for accessibility
7. Don't use tables for anything except tabular data

8. Enable resizable text that doesn't break the site
9. Avoid automatic media and navigation
10. Create content with accessibility in mind" [12]

Making a website accessible ensures that a variety of users can not just view the site but use it also. This can then guarantee the end user experience expected and that access and understanding to the information is available for all possible users. "The Web is fundamentally designed to work for all people, whatever their hardware, software, language, location, or ability. When the Web meets this goal, it is accessible to people with a diverse range of hearing, movement, sight, and cognitive ability". [10]

6.0 Conclusion

When launching a live website, it is important to consider the various aspects which can take time to implement but would benefit the business and website overall. The internet has become one of the most powerful tools within a work place and as result of this, a website which is being used to mainly advertise the business and its purpose, is required to apply and adapt the features which will ensure the return of the users.

Security involves so many aspects are vital to the running of a business, the website and both the software and hardware that is used. It is important to protect what keeps a business going, especially when security can be applied in numerous ways.

Scalability is important to apply early on, in the stages before the website is going to launched. No business can completely predict how successful a website can be and as a result of this, ensuring the site is prepared for a high user activity will aid the future of the website.

Usability like scalability, ideally should be applied in the early stages of development. Establishing usability aspects will guarantee a successful effective website which will allow the end users easy navigation and an interactive site.

Accessibility is significant for ensuring the business and its website is reached and used by as many end users as possible. Thinking of the target base who require the aspects of accessibility will aid the business in the long run and ensure there are no potential barriers produced, in the creation of the web presence.

7.0 Recommendations

For future research regarding the issues that should be considered when releasing a live website, further analysis would be conducted on additional aspects which could possibly be applied. Additional research would be initiated on the effects that could be brought by using Analytical tools and SEO (Search Engine Optimisation) techniques.

Both methods could be extremely useful when launching a website and will not only inform the business of how the site is performing, but SEO will aid in encouraging more possible users to visit the website. Added study into these methods would be of interest for additional analysis.

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10.0 Table of Figures

Figure 1.

Thomas, G. "SQL_Injection" Page 4. UWTSD Moodle. [Online]

Available: <https://moodle.uwtsd.ac.uk/course/view.php?id=2826>

Figure 2.

Thomas, G. "SQL_Injection" Page 5. UWTSD Moodle. [Online]

Available: <https://moodle.uwtsd.ac.uk/course/view.php?id=2826>

Figure 3.

Thomas, G. "Improving security with prepared statements" Page4. UWTSD Moodle. [Online]

Available: <https://moodle.uwtsd.ac.uk/course/view.php?id=2826>

Figure 4.

C. Dhall, Scalability Patterns: Best Practices for Designing High Volume Websites, SSBM Finance Inc., 2018, p. 12.

Figure 5.

C. Dhall, Scalability Patterns: Best Practices for Designing High Volume Websites, SSBM Finance Inc., 2018, p. 13.

Figure 6.

DCI "Google Services Temporarily Unavailable"[Online].

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L Collins - Web Report

GRADEMARK REPORT

FINAL GRADE

67 / 100

GENERAL COMMENTS

Instructor

WEBSITE

- Range of PHP coding demonstrated - A good range was demonstrated. Basic search facilities were demonstrated. Think about whether it is appropriate to show all the records on one page - as the site grows, this page could become very long! Administrator features (add/edit/delete) were present. Don't forget to validate - for example, when creating a new film - it should not be possible to leave all the fields blank. When registering, you should check to see if the username is already taken - if it is, the user should be prompted to enter a different username. Otherwise you will end up with a duplicate user.

Good use of populated pulldown menus and uploading images was made, and also the timestamp for displaying past/future movies

21/30

- Database structure and design –A good attempt. Think about combining the current and past/future reviews. This would make it easier to move between "states" as time goes on. The star rating might be slight overkill - no real need for a table for this, just a number would do. Reviews need to be referenced by a foreign key rather than a title, and also, currently the reviews are anonymous. It would be better to link via foreign key to the user so you know who has made the review.

5/10

- Overall Integration of Website - the layout is fairly basic, but the site is easy to navigate.

6.5/10

Knowledge and Understanding of Subject – On the whole, a good understanding of the site produced was demonstrated, but see my comments about the database. 13/20

REPORT

Research-informed Literature – Some good points identified - a bit too brief on some of them - for example, what is Cross Site Scripting exactly? a few examples needed. What website security tools could help secure the site for example. Very good discussion of scalability issues. The main usability and accessibility issues have also been identified - some good discussion here too.

12/15

Analysis – You have related how SQL Injection has been prevented on your website well, but what about the other security points? Is your site susceptible to XSS for example?

Regarding scalability, while the research on the topic is good, how does it apply to your site? What size could your website grow to and would the software eg mySQL used be suitable with a high number of rows. How do the usability and accessibility issues addressed hold up in your site. You could include some screenshots here to show how they do/do not.

9 /15

Overall a good report on the research side, but illustrate more how the points made apply to your site (you did this well with SQL Injection but you need to expand this to other points made)

Overall = 66.5%

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