MOBILE FRIENDLY WEB APP FOR CS DEPARTMENT

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in
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by
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DEDICATION

“To my beloved parents”
ABSTRACT OF THE THESIS

Mobile Friendly Web App for CS Department
by
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Master of Science in Computer Science
San Diego State University, 2012

Over the past few years mobile technology has improved significantly. Mobile devices are being released to market with sophistication in both hardware and software. Mobile web usage has increased to such a point that web developers and designers cannot afford to ignore it. There has been immense improvement in mobile device software technologies especially for the web browsers. These technologies are being explored based on a powerful toolkit and frameworks which support web page rendering. The purpose of this research is to understand the concepts of mobile technology and the current applications of this technology by creating an actual project for the Computer Science Department of San Diego State University.
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GLOSSARY

SDSU: San Diego State University

Department: Department of Computer Science, San Diego State University

CES: College of Extended Studies. San Diego State University

GMCS: Geology, Mathematics and Computer Science Building

Regular Website/Regular Webpage/Desktop Website: Website/Webpage that is designed for Desktop Computers and Laptops.

Department's Mobile website: Refers to a Mobile website for this project.

Smartphones: A smartphone is a mobile phone built on a mobile computing platform with more advanced computing ability and connectivity than a feature phone [1].

HTTP: Hypertext Transfer Protocol, HTTP is the core foundation for data communication on World Wide Web.

HTML 5: A markup language for structuring and presenting content for World Wide Web.

CSS 3: Cascading Style Sheet, A style sheet language used for describing presentation semantics of a document written in markup language.

PHP: Hypertext Preprocessor, A general-purpose web development scripting language.

W3C: The World Wide Web Consortium (W3C) is the main international standards organization for the World Wide Web.
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CHAPTER 1

BACKGROUND

Mobile Web access is the next big thing for both mobile devices and Web services [2]. People are becoming reliant on the Web for their day-to-day activities. A desktop or laptop computer is not the only way to browse the web anymore. By 2013, mobile phones will overtake desktop and laptop computers as the most common Web access device worldwide [3].

This research addresses issues in the Computer Science Department’s existing desktop website regarding mobile devices, and the need for the design and implementation of a mobile website for this department at San Diego State University. A mobile website will not only be effective for students and professors to extract important information but will significantly improve user experience and satisfaction. And this experience will create a positive impression for its user.

1.1 STATEMENT OF THE PROBLEM

The existing website of San Diego State University’s Department of Computer Science does not follow the guidelines necessary for usable mobile access [Section 2.3.2]. Data organization is not well managed for the mobile web. Mobile-specific features, such as click-to-call, click-to-email and Google maps do not exist. Furthermore, the Department website is specifically designed for desktop, and it is not efficient for users to browse a regular website on their smartphone [4].

Figure 1.1 (on June 29, 2012) shows the existing regular website of the Computer Science Department on a mobile browser. Mobile phones do not have the screen capabilities to view a regular web page. Regular web pages may look unclear on mobile phones. Also loading a regular web page on a mobile phone is time consuming [Section 2.3.1.2].
1.2 PURPOSE OF THE STUDY

The purpose of this study is to provide the Computer Science departmental information research, professors’ office hours, news, opportunities, etc., directly on mobile devices in an attractive and effective way in order to meet the needs of the Department. In addition, this study seeks to provide the mobile website with mobile specific features.

1.3 SPECIFIC IMPROVEMENT GOALS

Mobile users face four main usability hurdles: small screens, awkward input, download delays and poorly-designed sites [4]. One of the major goals of this project is to make the department website more attractive and clear for a mobile browser. Another major improvement goal is to add Maps, Click-to-call and e-mail features to the website. Nowadays, smartphones come with GPS capabilities. By using Google API, we can include a number of services for customization and add content to the Map. Adding map functionality to the website makes it very convenient to search the parking lots, library and Computer Science Department.
CHAPTER 2

LITERATURE REVIEW

2.1 INCREASE IN INTERNET USE ON CELL PHONES

The most important thing we should consider for designing a Mobile Website is the statistics on Internet use on cell phones and smartphones. According to a Pew Research Center report some 88% of U.S. adults own a cell phone of some kind as of April 2012, and more than half of these cell phone owners (55%) use their phone to go online [5]. This represents a notable increase from the 31% of cell phone owners who said, as recently as April 2009, that they used their phone to go online [6].

Smartphones have the ability to access information on the Internet, either through a browser or through the thousands of apps available. According to Go-Gulf.com’s Smartphone Usage Statistics 2012 Report, “Out of the 5 billion mobile phones in the world, 1.08 billion are smartphones.” Figure 2.1 shows Feature Phones vs. Smartphones [7].

2.2 NEED OF MOBILE FRIENDLY WEBSITE

Need of mobile friendly website is explained briefly on the basis of mobile traffic, browsing experience and multiplatform mobile app.

2.2.1 Exploding Mobile Traffic

Online advertising network Chitika finds Mobile Web browsing continues to take off, with smartphones and tablets accounting for 20 percent of Web traffic in the U.S. and Canada, according to a new report on May 25, 2012 as shown in Figure 2.2 [8]. That means that one out of every five visitors to websites in the U.S. is using a mobile device to do so.


2.2.2 Simplified Browsing Experience

While modern smartphones can adapt to a desktop website (except flash for iPhone), mobile users expect a site that loads quickly, is easily navigable (without pinch zooming) and contains plenty of functions and sections that are pertinent to mobile users [9]. In the example below you can see the difference between the Wired.com desktop website (Figure 2.3) and its mobile version (Figure 2.4).
Figure 2.3. Wired.com desktop website on mobile device. Snapshot taken on June 29, 2012.

Figure 2.4. Wired.com mobile. Snapshot taken on June 29, 2012.
While the desktop version makes a more attractive website, the functionality of the mobile website far exceeds the user experience than the desktop version on mobile devices. Also the mobile website (Figure 2.4) is simple, straight-forward and easily navigable by mobile users.

### 2.2.3 Eliminate need of Multiplatform Mobile App

The chart (Figure 2.5) shows a mobile smartphone OS breakdown from the past seven years. While the market share of Symbian, RIM, Palm and Microsoft’s OSes have been shrinking over the years, the mobile OS market is still very fragmented [10]. Considering these statistics a single mobile website is a better investment than spending time and budget on Android and iOS apps.


### 2.3 NEED OF MOBILE WEBSITE FOR DEPARTMENT

To check the mobile friendliness of the Computer Science Department's desktop website, the following tests were performed.

1. W3C mobileOK checker
2. Google's GoMo Testing
2.3.1 W3C mobileOK Checker

To help ensure that an appropriate user experience *Mobile Web Best Practices Working Group*, part of the W3C Mobile Web Initiative defined a set of recommended guidelines to follow when creating mobile websites [11]. The intention of mobileOK is to help catalyze development of Web content that provides a functional user experience in a mobile context.

W3C mobileOK checker testing was performed on the following pages of the Department's desktop website, and the results are shown in tabular format (Table 2.1). The author has selected the pages for testing based on regular updates (News and Calendar), importance of information (Faculty) and user specific information (Web and Mobile Certification).

Table 2.1. W3C mobileOK Checker Results of Department’s Desktop Website on June 29, 2012

<table>
<thead>
<tr>
<th>No.</th>
<th>Test</th>
<th>Severity</th>
<th>Landing Page</th>
<th>Web &amp; Mobile Certification</th>
<th>Calendar</th>
<th>Faculty</th>
<th>News</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mobile Friendliness</td>
<td>-</td>
<td>5%</td>
<td>24%</td>
<td>32%</td>
<td>31%</td>
<td>0%</td>
</tr>
<tr>
<td>2</td>
<td>Total size of page</td>
<td>Critical</td>
<td>38.5 KB</td>
<td>28.5 KB</td>
<td>29.5 KB</td>
<td>29.5 KB</td>
<td>10.4 MB</td>
</tr>
<tr>
<td>3</td>
<td>Nested Tables</td>
<td>Critical</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>4</td>
<td>Caching</td>
<td>Medium</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
</tbody>
</table>

Following is the list of pages from department’s desktop website tested on W3C mobileOK checker.

1. Home Page
2. Web and Mobile Certification
3. News
4. Calendar
5. Faculty
2.3.2 Result Analysis

The following section shows result analysis of W3C mobileOK checker test on department’s desktop website.

2.3.2.1 TOTAL SIZE OF PAGE

W3C mobileOK checker test conducted on landing or index, web and mobile certification, calendar, faculty and news shows 38.5 KB, 28.5KB, 29.5KB, 29.5 KB and 10.4 MB total page sizes(including images) respectively. Big pages require a possibly high cost and a long waiting time in many mobile networks [12]. For instance, on many mobile networks, downloading 100KB worth of data takes as long as 1 minute [12]. Page size for news page is 10.4 MB which not only takes time to load but consumes more data.

To make website mobile friendly W3C mobileOK checker basic recommendation [12] suggests following changes

1. Scale down the images to reasonable size.
2. Remove images that are not essential to the layout of the page.
3. Separate CSS styles defined for screen (laptop, desktop etc.) and handheld (mobiles, tablets etc.) media types.

2.3.2.2 NESTED TABLES

All the tested pages of department desktop website contain nested tables. Tables do not work well on limited size screens and may result in the user having to scroll horizontally to read those [12]. Also putting links into tables may result in the user having both to scroll horizontally and vertically to see possible navigational choices. W3C mobileOK basic test recommendation suggests avoiding nested tables [12].

2.3.2.3. CACHING

Providing caching information helps mobile browsers reduce the number of network accesses, making it quicker and cheaper to load pages. All tested pages of department desktop website do not have caching information. W3C mobileOK basic test recommendations suggests enabling caching either through server or within a script which is being used to generate page [12].
2.3.2.4. MOBILE FRIENDLINESS

By considering above major test as well as some minor tests like image size (height and width), image format, character set information, table element using less than two tr element W3C mobile OK checker assigned score to each page which determines it’s mobile friendliness. The mobile friendliness of Landing or index page, web and mobile certification, calendar, faculty and news is 5%, 24%, 32%, 31% and 0% respectively.

2.3.3 Google's GoMo Testing

Google's GoMo tool shows you how your current site looks on a smartphone, and provides a report on what’s working and what you can do better.

Some of the important web pages of the Department's desktop website are tested on the GoMo tool and results are shown in Table 2.2. The author has selected the pages for testing based on regular updates (News and Calendar), importance of information (Faculty) and user specific information (Web and Mobile Certification).

Following is the list of pages from department’s desktop website tested on GoMo testing tool.

1. Home Page
2. Web and Mobile Certification
3. News
4. Calendar
5. Faculty

2.3.4 Result Analysis

The following section shows result analysis of GoMo testing on department’s desktop website.

2.3.4.1 ZOOMING AND SCROLLING REQUIRED

Mobile devices have small screens, so it’s important to make information on website easy to read and scan by using bullet points and dividing content into small chunks [13].
Table 2.2. GoMo Testing Results of Department’s Desktop Website on June 29, 2012

<table>
<thead>
<tr>
<th>No.</th>
<th>Test</th>
<th>Landing Page Index.html</th>
<th>Web &amp; Mobile</th>
<th>Calendar</th>
<th>Faculty</th>
<th>News</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Zooming required to read</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>2.</td>
<td>Scrolling required to read</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>3.</td>
<td>Links and buttons clicked with thumb</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>4.</td>
<td>Total Time (Loading + rendering) (seconds)</td>
<td>0.25</td>
<td>0.04</td>
<td>0.06</td>
<td>0.06</td>
<td>104.24</td>
</tr>
<tr>
<td>5.</td>
<td>Overall Score (out of 6)</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Figure 2.6 shows department’s desktop website news page. It requires zooming and scrolling horizontally to read the information clearly. Similarly all other pages e.g. landing page, web & mobile certification, faculty and calendar requires zooming and horizontal scrolling to read the information clearly.

GoMo testing suggests use of appropriate font size and lay out text so that user doesn’t have to zoom. If scrolling can't be avoided keep it vertical.

2.3.4.2 LINKS AND BUTTONS

People use their fingers to operate mobile devices. Tiny links and buttons can be difficult to click with human fingers and thumbs.

Figure 2.7 shows department’s desktop website's landing and faculty page on dolphin browser of iPhone. The buttons and links are tiny and not clickable with thumbs or fingers. All other pages like web & mobile, calendar and news have the same problem.
Figure 2.6. Department desktop website news page. Snapshot taken on June 29, 2012.

Figure 2.7. Department desktop website on mobile device. iPhone Dolphin browser. Snapshots taken on June 29, 2012.
GoMo testing suggests use of wide buttons and some extra space around it so that user don't hit wrong button.

2.3.4.3 TOTAL TIME (LOAD RESOURCES AND RENDERING PAGE)

Total time represents time required for loading resources and rendering page in browser. A survey by Compuware shows that close to 50% of users will wait just five seconds or less before giving up on a site [14]. Mobile consumers are often in a hurry, and become frustrated when they can’t complete a task quickly [13]. Results shows that total time to load and render department’s desktop website pages on mobile device is less than 5 seconds except a news page. GoMo test suggest following to reduce the total time.

1. Prioritize the content and feature.
2. Reduce large blocks.
3. Compress images to keep them small and load faster.

2.3.4.4 OVERALL SCORE

Overall score (Out of 6) considers all the points mentioned above (Zooming and scrolling, links and buttons and total time) and calculate the score on basis of that. All the tested pages of department’s desktop website get overall score of 2 out of 6 except a news page which is having 0 score. This score can be increased by implementing the suggestions by GoMo testing.

2.4 CONCLUSION

Results from the W3C MobileOK checker and GoMo Mobile testing show that accessing the Department’s desktop website on a mobile device often results in a poor or unusable experience. Because of the limited screen size and the limited amount of material that is visible to the user on mobile device pages, these pages may not be laid out as intended. With W3C mobileOK checker and Google's GoMo testing we can conclude that there is a need for a mobile-specific website for the Department of Computer Science at San Diego State University.
CHAPTER 3
DESIGN

In the previous chapters we discussed issues with the existing Department's desktop website on mobile devices. This chapter discusses the design phases for the Department's mobile website.

There were three steps followed in designing this project.
1. Studying mobile web best practices
2. Choosing Languages and Frameworks
3. Designing a Mobile Website

3.1 MOBILE WEB BEST PRACTICES

W3C recommendations for Mobile web design define basic guidelines for mobile website design. This document specifies Best Practices for delivering Web content to mobile devices [15].

W3C mobile best practices for a mobile web are grouped under the following headings:
1. Overall Behavior
2. Navigation and Links
3. Page Layout and Content
4. Page Definition

3.1.1 Overall Behavior

There are some general principles that should be considered while building a mobile site.

3.1.1.1 THEMATIC CONSISTENCY OF RESOURCES IDENTIFIED BY A URI

One Web principle states that content should be accessible on a range of devices irrespective of differences in presentation capabilities and access mechanism [16]. Example:
Figure 3.1 and Figure 3.2 show MIT Mobile website on Android and iPhone 4 devices respectively.

Figure 3.1. MIT mobile website on Android. Snapshot taken on July 01, 2012.

Figure 3.2. MIT mobile website on iPhone. Snapshot taken on July 01, 2012.
3.1.1.2 TESTING

Mobile browsers have different characteristics than the desktop browsers. Therefore it is important to assess a website's suitability for display in a reduced format. This makes it important for the content providers to test whether the features they rely on work in actual devices for a range of browsers (Figure 3.3).

Figure 3.3. About.com on (1) Safari (Version 5.1), (2) Opera (Version 7.0.3), (3) Chrome (Version 21.0.1180.80) and (4) Dolphin (Version 6.0). Snapshots taken on July 01, 2012.
3.1.2 Navigation and Links

To define the structure and navigation model of a website, special care should be taken to consider the limitations in display and input mechanisms, the possible absence of a pointing device, and other constraints of mobile devices.

3.1.2.1 URIs of Site Entry Points

When accessing website entry points, users should not have to enter a filename as part of the URI.

For example, instead of requiring users to type:
http://www.example.org/example.html
Allow: http://example.org/example

3.1.2.2 Navigation Bar

Many web pages are designed with significant navigational and other elements at the top of or to the side of the page (Menu Bars, Search Functions, etc.). On mobile devices this can result in the navigation appearing instead of the actual content of the page when the page is first retrieved. Example: slashdot.org TV website

Figure 3.4 shows the Slashdot TV website on a mobile device. Red boxes show the search functionality and the Menu bar at top of the page. Because it is important for the user to gain an idea of the content of the page on initial view, there should be a minimal amount of clutter, such as navigation, decorative images, advertising and other material that is not central to the user's experience of the page [15].

3.1.2.3 Balanced Structure

The mobile website should have a good balance between the number of navigation links on a page and the need to navigate multiple links to reach content.

A guideline is that users become frustrated if it takes more than four retrievals to reach their objective [15]. Example: Stanford University Mobile Website; Section: Athletics

As shown in Figure 3.5, it only takes four retrievals to reach the baseball schedule.
3.1.3 Page Layout and Content

Page layout and content concentrate on design, the language used in its text, and the spatial relationship between constituent components.

3.1.3.1 PAGE CONTENT

Users in a mobile context are often looking for specific pieces of information, rather than browsing, so while providing options to all information, mobile websites should provide appropriate information first [15].

Figure 3.6 and Figure 3.7 show Science Magazine desktop and mobile website respectively. Mobile website shows only the important features on the home page.

3.1.3.2 PAGE SIZE

Many mobile networks take long downloading times and, therefore, incur high costs accessing web pages. For instance, on many mobile networks, downloading 100KB worth of data takes as long as 1 minute [17]. The size of web pages should be considered while designing the mobile website.
Figure 3.5. Screenshots from 1 to 4: Navigation in Athletics section. Snapshot taken on July 01, 2012.

Figure 3.8 shows SDSU Computer Science Department's News page on mobile device. This page takes 104.6 seconds to load and consumes 10.4MB of data.

3.1.3.3 SCROLLING

The page should render on browser so that simple repeated scrolling in the same direction (axis) allows the user to experience all of its content [15].

Figure 3.9 shows vertical scrolling on mobile website pages. It's very easy to see highlights of all the important content on one page scrolling vertically.
3.1.4 Page Definition

Page definition concentrates on title text, image size (height and width) and use of cache headers for mobile web pages.
3.1.4.1 Title

Provide a descriptive title for the page to allow easy identification. Keep the title short to reduce page weight and to avoid text truncation as shown in Figure 3.10. W3C mobile web best practices suggest providing a short but descriptive page title.
3.1.4.2 IMAGE SIZE

Resizing images at the server reduces the amount of data transferred and the amount of processing the device has to carry out to scale the image.

Example: Figure 3.8 shows the amount of data received while receiving pages from server which contain images.

3.1.4.3 CACHE HEADERS

Limited bandwidth and high latency can reduce the usability of websites on mobile devices [15]. Using caching information effectively can reduce the need to reload data such as style sheets, images and pages, thus improving performance and reducing usage cost. W3C mobile web best practices suggest providing caching information in HTTP responses.

3.2 CHOOSING LANGUAGES AND FRAMEWORKS

Over the past years, W3C has developed a number of Web technologies that explicitly take into account the specificities of mobile devices. The latest generation of mobile browsers is capable of using more advanced Web technologies, like HTML 5, CSS 3 and Javascript [18]. This section discusses programming languages and frameworks used for developing the Department's mobile website.
3.2.1 HTML 5

HTML 5 was developed to give more structure to websites for designers and developers [19]. HTML 5 is not a new language but an HTML with an extended layer of standardized tags and attributes for graphic and visual effects that reduces the need for special plugins [19]. HTML 5 adds many new features like <audio>, <video>, <canvas> as well as integration of Scalable Vector Graphics (SVG). These new features can handle multimedia easily so that we don't have to depend upon APIs and plugins. The semantic contents of document is improved with <section>, <article>, <header> and <nav>. Some of the prominent features of HTML 5 are Local data storage, Geolocation support, Animation and Visual effects with the help of javascript, Real-time Communication, File and Hardware access and Device Orientation.

Some of the new tags introduced in HTML 5 are:

- <article>: represents the independent section of a document, page or site. This could be a forum post, a magazine or newspaper article, a blog entry, a user-submitted comment, or any other independent item of content [20].
- <canvas>: represents a resolution-dependent bitmap canvas, which can be used for rendering graphs, game graphics, or other visual images on the fly [20].
- <command>: represents a command that users can invoke [20].
- <header> and <footer>: <header> used to wrap introductory content or a set of navigation links. <footer> contains information about author, copyrights, and privacy policy, etc.
- <figure>: Used to mark up diagrams, Photos, code examples etc.

HTML5 tags are parsed by the browser to display the given page content in a Document Object Model (DOM), which is a hierarchy of objects within the document. Animations and other visual effects are accomplished through the use of the <canvas> tag, JavaScript, SVG, and CSS [19].

CSS 3 builds on CSS 2 module by module [21]. CSS 3 features include opacity, font-face, border radius, Box-shadow, Text-shadow, Gradient, and multiple background images, etc.

3.2.2 jQuery Mobile

Jquery mobile is a touch optimized web framework that includes Javascript libraries for mobile web pages. Jquery mobile is compatible with all major mobile, tablet, e-reader
and desktop platforms - iOS, Android, Blackberry, Palm WebOS, Nokia/Symbian, Windows Phone 7, MeeGo, Opera Mobile/Mini, Firefox Mobile, Kindle, Nook, and all modern browsers with graded levels of support [22].

Jquery mobile uses powerful Ajax navigation, which provides animated transitions. The framework is built around the principle of progressive enhancement and uses the HTML 5 and CSS3 features but degrades nicely for browsers that don't support them [22]. Jquery mobile offers various components like pages-dialogs, toolbars, buttons, content formatting, form elements and list views as well as the ThemeRoller application which makes highly-branded experiences easy to build [22].

### 3.2.3 PHP and MySQL

PHP Hypertext Preprocessor is a widely-used open source general-purpose scripting language that is especially suited for web development and can be embedded into HTML [23]. The Department’s mobile site information like News or Thesis Defense is stored in MySQL database. PHP is used to talk with the MySQL database and fetch data to render on the HTML page.

MySQL is cross platform, open source and the world’s most used RDBMS. MySQL is most frequently used in web applications.

### 3.3 Designing Department's Mobile Website

The first step in this project was to study the W3C mobile web best practices and set a goal to follow the basic guidelines for a mobile website. The second part was to choose appropriate programming language and frameworks. The third step shows how the mobile website is built.

A site diagram is very helpful when a project moves from planning to actual Web page production. As the new site is built up in a directory on the Web server, the site diagram is often the first place programmers look to gain an understanding of how the site files should be subdivided into directories ("folders") on the server [24].

Let’s look at the site diagram of the Department's mobile website.

As shown in Figure 3.11, the Index page (home page) is the landing page for the Department's mobile website. The Index page contains icons through which we can navigate to News, Faculty, Admissions, and Web & Mobile, etc. All of these pages are built on an
Figure 3.11. Site diagram: department's mobile website.

HTML 5 and Jquery mobile framework. Some of the pages, such as News, Advisors, Faculty, and Opportunities required data feed from the database which is obtained by sending parameters and invoking backend PHP script. PHP scripts with database queries fetch data from database. This data is rendered in HTML 5 with the help of PHP.
3.3.1 Basic HTML 5 Page Structure

Department mobile website pages are developed with HTML 5. HTML 5 provides consistent set of elements for everyone to use for the common structural blocks.

Following code shows the basic HTML 5 page structure.

```html
<!DOCTYPE html>
<html lang="en">
  <head>
    <meta charset="utf-8" />
    <title>Example</title>
  </head>
  <body>
    <header>Page Header</header>
    <section>
      <header>Section header</header>
      <article>
        <header>Article Header</header>
        <p>Article paragraph</p>
        <footer>Article Footer</footer>
      </article>
    </section>
    <footer>Section Footer</footer>
  </body>
</html>
```

Some of the major components of this page are:

1. **<!DOCTYPE html>**: It’s not a HTML tag. It is used for specifying what language and version the document is using to web browser.

   **<head>**: Contains title for document and can include scripts, meta information and styles.

   Jquery mobile framework is used in department’s mobile website which is included in <head> by making references to Jquery, Jquery Mobile and the mobile theme CSS.

   As shown in code below references are made to Jquery mobile CSS, Jquery and Jquery mobile which is included in <head> tag.

   ```html
   <link rel="stylesheet" href="http://code.jquery.com/mobile/1.0a4.1/jquery.mobile-1.0a4.1.min.css" />
   <script src="http://code.jquery.com/jquery-1.5.2.min.js"></script>
   <script src="http://code.jquery.com/mobile/1.0a4.1/jquery.mobile-1.0a4.1.min.js"></script>
   ```
The CSS used for department mobile website pages is included in `<head>`
```html
<link type="text/css" rel="stylesheet" href="maincss.css"/>
```

2. `<meta>`: Typically used for document description, keywords, author of document, last modified and other meta information. To display an HTML page correctly, the browser must know what character-set to use. As shown in code below Character set and caching information is provided with the help of `<meta>` tag.
```html
<meta http-equiv="Content-Type" content="text/html; charset=UTF-8" />
<META HTTP-EQUIV="CACHE-CONTROL" CONTENT="PUBLIC">
```

3. `<body>`: Wrap all the content of an HTML document such as images, tables, and lists, etc.
As department mobile website uses Jquery mobile framework, `<body>` tag includes “data-role” which identifies a view or page.
```html
<body>
  <div data-role="page">
    <div data-role="header">...</div>
    <div data-role="content">...</div>
    <div data-role="footer">...</div>
  </div>
</body>
```

### 3.3.2 Basic Jquery Mobile Page Structure

The single Jquery Mobile page structure is either a single page or internally linked pages within a page. Department’s mobile website uses Jquery mobile on all pages.

The following code shows the basic Jquery mobile page structure.
```html
<!DOCTYPE html>
<html>
  <head>
    <meta charset="utf-8" />
    <title>Demo</title>
    <link rel="stylesheet" href="http://code.jquery.com/mobile/1.0b2/jquery.mobile-1.0b2.min.css" />
    <link type="text/css" rel="stylesheet" href="maincss.css" />
    <script type="text/javascript" src="http://code.jquery.com/jquery-1.6.2.min.js"></script>
    <script type="text/javascript" src="http://code.jquery.com/mobile/1.0b2/jquery.mobile-1.0b2.min.js"></script>
  </head>
  <body>
    <div data-role="page">
      <div data-role="header"> <h1>Page Title</h1></div>
      <div data-role="content"><p>Page content goes here.</p>
      </div>
      <div data-role="footer"></div>
    </div>
  </body>
</html>
```
Major sections and Jquery mobile features used in department’s mobile website are as follows

1. **<head>** The Jquery mobile page starts with HTML 5 ‘doctype’ to take full advantage of all framework features. In the `<head>` tag references to Jquery, Jquery mobile and mobile theme CSS is required.

   ```html
   <!DOCTYPE html>
   <html>
   <head>
   <title>Faculty & Staff</title>
   <link rel="stylesheet" href="http://code.jquery.com/mobile/1.0a4.1/jquery.mobile-1.0a4.1.min.css" />
   <link type="text/css" rel="stylesheet" href="maincss.css" />
   <script src="http://code.jquery.com/jquery-1.5.2.min.js"></script>
   <script src="http://code.jquery.com/mobile/1.0a4.1/jquery.mobile-1.0a4.1.min.js"></script>
   </head>
   <body>
   .
   .
   </body>
   </html>
   ```

2. **<body>** Inside the body tag each view or page is identified by “data-role” attribute.

   ```html
   <div data-role="page"> .
   <div data-role="header">.
   <div data-role="content">.
   <div data-role="footer">.
   </div>
   </div>
   </div>
   ```

### 3.3.3 Internal and External Linking

A single HTML document containing multiple pages that are loaded together and linked internally within the page were used almost in all pages of department’s mobile website. For example as shown in code below the Faculty page on department’s mobile website have internally linked pages like full time faculty, part time faculty, staff and emeritus.

```html
<ul data-role="listview" data-inset="true">
  <li><a href="#fulltimefaculty">Full Time</a></li>
  <li><a href="#parttimefaculty">Part Time</a></li>
</ul>
```
External linking is used on Home page or landing page of department’s mobile website to navigate through icons.

For example as shown in code below to navigate through News icon provided on home page user can navigate to News page.

```html
<a href="newsevents.html" rel="external">
```

### 3.3.4 Back Linking

As suggested by *W3C mobile web rules* home button is provided on each page on department’s mobile website which refers to home page or landing page. This is achieved by using back linking.

For example as shown is code below back link is provided to home page or landing page.

```html
<a href="index.html" rel="external" data-icon="home" data-iconpos="left" data-direction="reverse" class="ui-btn-left">Home</a>
```

### 3.3.5 Accessing Database with PHP

PHP is server-side HTML embedded scripting language. PHP scripts were widely used in this project. One of the major uses of PHP was accessing the database. The following code shows the use of PHP to connect with the database and access the newstable.

```php
<?php
    include("config.php");
    mysql_connect(localhost,$username,$password);
    @mysql_select_db($database) or die("Unable to select database");
    $query="SELECT * FROM newstable";
    $result=mysql_query($query);
    $num=mysql_numrows($result);
    mysql_close();
?>
```

Department’s mobile website pages like News (News, Calendar, Bits & Bites), Faculty and Opportunities gets data feed from database. Above sample code is used to fetch the database and this data is rendered on browser with the help of HTML 5 and Jquery mobile.
All major database tables used in Department’s mobile website are shown in Table 3.1.

**Table 3.1. Major Database Tables**

<table>
<thead>
<tr>
<th>TABLE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
</table>
| **newstable** | id: int
| | title: text
| | description: text
| | image: varchar |
| **thesisinfo** | id: int
| | title: varchar
| | speaker: varchar
| | date: date
| | time: varchar
| | location: varchar
| | advisor: varchar
| | abstract: varchar |
| **contactinfo** | id: int
| | first: varchar
| | last: varchar
| | email: varchar
| | office: varchar
| | phone: varchar
| | website: varchar
| | faculty_type: varchar
| | advisor: varchar |
| **bits** | id: int
| | title: varchar
| | date: date
| | time: varchar
| | location: varchar
| | abstract: varchar |
| **opportunityinfo** | id: int
| | name: varchar
| | file_name: varchar |
CHAPTER 4

IMPLEMENTATION

This chapter discusses the implementation of the Department's Mobile Website. Website address/URL and barcode for department’s mobile website implemented in this thesis are provided in Appendix: Useful Links.

Different sections in Department's Mobile website are as follows:

1. News
2. Faculty
3. Admissions
4. Web & Mobile
5. Student Info
6. Opportunities
7. Forms
8. Maps
9. Contact Us

4.1 News

This section provides channels for the information listed below. Information presented in this section resides on MySQL database. The author has used PHP for server side scripting and fetching information from database. On extracting the data from the database, it is processed and rendered on the browser using HTML 5 and CSS (Figure 4.1).

4.1.1 News

This page provides the latest and archived news and information of the Department.

4.1.2 Calendar

The Calendar consists of the schedule for the future thesis defense. The schedule also has a snippet of a thesis abstract.
4.1.3 Bits & Bites

Bits and Bites is a program run by the Department to provide a platform for students and professors to meet socially and discuss the ideas and build future technologies.

4.2 Faculty

This section provides information on the Department faculty. Faculty information resides on MySQL database, and this information is rendered on the HTML 5 page with the help of PHP script.

Click to call, email on click are features of HTML and can easily be embed in HTML 5 code.

For Example:

- Click-to-call code in HTML 5

  <a href="tel:+18002752273">Call Apple Customer Support at 1-800-275-2273</a>
Click-to-email code in HTML 5

<a href="mailto:homer@example.com">Email Homer</a>

These features are used in the Department's mobile website so that students can send an e-mail or call a faculty with just one click (Figure 4.2).

Figure 4.2. Shows calling on click, emailing and visiting the Faculty page on a click. Snapshot taken on July 16, 2012.

4.3 ADMISSIONS

Information about Undergraduate, Graduate and Certification is most important data for freshmen as well as professionals looking for certification(s). On the mobile website
students can get information about the Department's admission process and relevant topics. Direct links to SDSU admission websites of Graduate, Undergraduate and Certification are provided as shown in Figure 4.3.

![Figure 4.3. Direct link to SDSU Admission website. Snapshot taken on July 16, 2012.](image)

### 4.4 Web and Mobile

Web and Mobile Certification play a very important role in the Department of Computer Science. Getting appropriate information about certifications in the Department is a crucial factor for students. With Web and Mobile Certification placed on a landing page in the mobile website it's easier to get information about this with a click as shown in Figure 4.4.

### 4.5 Student Info

Graduate, Undergraduate and Certification information with requirements, advisors, master’s exam information, etc., is extremely useful for the users. This information is systematically arranged and displayed as shown in Figure 4.5.

### 4.6 Opportunities

There are lots of job opportunities from different companies for intern recruitments as well as full-time jobs offered directly to the professors and the Department. Some professors
share this information on the notice board and some send them using emails. There is no common space where all the information can be shared and archived quickly and efficiently. The ideal solution would be a mobile website.
4.7 FORMS

Smartphones have built-in wireless print capabilities to the networked servers and printers. There are a huge number of departmental forms which reside on the regular website. By using the existing forms on the mobile website and using the wireless print capabilities of the smartphone, a user can print forms that are available on a mobile website. Department form on department’s mobile website as shown in Figure 4.6

![Image of a form]

Figure 4.6. Forms. Snapshot taken on July 16, 2012.

4.8 MAPS

New and existing students find it difficult to search a specific area or building on the university campus, such as departments, parking lots and more important, the library.

Google Maps API is a free service, available for use on any website that is free to consumers. It enables you to embed Google Maps in your web pages and includes a number of services for customizing and adding content to the map. Geolocation for GMCS, SDSU library and parking lots are used to display respective maps in HTML 5 (Figure 4.7).
4.9 CONTACT US

The SDSU address, department contacts and other contact information are displayed here. Also the developer’s information for this mobile site is displayed here for feedback (Figure 4.8).
CHAPTER 5

TACKLING ISSUES

This chapter discusses the major issues tackled in building the Department’s mobile website.

5.1 SYNCHING MOBILE WEBSITE INFORMATION

One of the major issues in building a mobile website is the availability of the same data on both the mobile website and its desktop version. Sections like News, Calendar, Bits & Bites, and Opportunities are updated regularly. To ensure the availability of the same data on both website versions (Mobile and desktop), an Admin Panel was built to feed data into the database for the mobile website. However, due to the different databases for the mobile website and desktop website, the administrator needs to copy all data (i.e., News, Thesis, Bits & Bites and Faculty Info) and upload it to the mobile website database with the Admin Panel.

This Admin Panel resides on the same server as a mobile website. The following figures show some of the basic features needed to feed data into the database. Figure 5.1 shows the categories available, such as News, Thesis, Bits & Bites, Faculty Info, and Opportunities for Add, Edit and Delete in the admin panel.

![Figure 5.1. Thesis list.](image-url)
Figure 5.2 shows the “Edit Record” feature for the category, Bits & Bites.

![Image of the Edit Record feature for Bits & Bites category](image_url)

**Figure 5.2. “Edit Record” category (bits & bites).**

Figure 5.3 shows the “Add New Record” for the News category.

![Image of the Add New Record feature for News category](image_url)

**Figure 5.3. “Add New Record” for news.**

### 5.2 Image Sizes and Image Disk Footprint

One of the major considerations in the W3C mobile web best practices (Section 3.1.4.2) is Image size and the disk footprint of the image. The News section of this project contains images which should be reduced in size and memory consumption (disk footprint) for optimized mobile pages. This was done with PHP scripting through the Admin Panel while uploading the image.
The admin panel of this project uses a PHP code to reduce the size of the image and its disk footprint.

PHP code is as follows:

```php
$temp_image = imagecreatetruecolor($temp_width, $temp_height);
imagecopyresampled($temp_image, $source_image, 0, 0, 0, 0, $temp_width, $temp_height, $source_width, $source_height);
```

5.3 DETECTING DEVICE TYPE

This project is designed for both smartphones and tablets. The mobile version of the Department’s website should render on both smartphone and tablet according to device width and height. The major issue of enabling web pages according to the device type is accomplished with the help of media queries [25]. Media queries allow tweaking of the layout without having to make significant changes.

HTML 5 Code with Media Queries:

```html
<link rel="stylesheet" media="all" href="maincss_all.css" />
<link rel="stylesheet" media="only screen and (max-width: 700px)" href="maincss.css" />
```

To make the Department's mobile website and tablet compatible, two different types of CSS were used depending upon the device type. If the device is mobile then maincss.css is loaded and when the device is tablet (screen width > 700px) maincss_all.css is loaded.
CHAPTER 6

TESTING

Testing a mobile website on the vast number of mobile devices available can be time consuming and expensive. But there are some tools available to make sure that the website is rendering appropriately on the mobile web. This project was tested on W3C mobileOK checker and Google's GoMo Testing. The author has selected the pages for testing based on regular updates (News and Calendar), importance of information (Faculty) and user specific information (Web and Mobile Certification).

6.1 W3C MOBILEOK CHECKER

The Department's mobile website was tested on W3C mobileOK checker and the results are shown in Table 6.1.

6.2 RESULT ANALYSIS

The results of W3C mobileOk checker and suggestions on department desktop website are discussed in Section 2.3. Following section shows analysis on department’s mobile friendly website.

6.2.1 Total Size of Page

Total size of landing or index page, web and mobile certification, calendar, faculty and news is 134KB, 65.4KB, 60.1KB, 72.7KB and 134.6KB respectively. Total size of index and news page is exceeding the limit of 100KB. Images rendered on news page were compressed with PHP code while uploading through admin panel as explained in section 5.2.

6.2.2 Framesets, Frames or iframes

No pages on department’s mobile website consist of framesets, frames or iframes which follows W3C mobileOK checker suggestion.
### Table 6.1. W3C mobileOK Checker Results for Department Mobile Website

<table>
<thead>
<tr>
<th>No.</th>
<th>Test</th>
<th>Severity</th>
<th>Landing Page</th>
<th>Web &amp; Mobile Certification</th>
<th>Calendar</th>
<th>Faculty</th>
<th>News</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mobile Friendliness</td>
<td>-</td>
<td>51%</td>
<td>63%</td>
<td>63%</td>
<td>57%</td>
<td>54%</td>
</tr>
<tr>
<td>2.</td>
<td>Total size of page(in KB)</td>
<td>Critical</td>
<td>134</td>
<td>65.4</td>
<td>60.1</td>
<td>72.7</td>
<td>134.6</td>
</tr>
<tr>
<td>3.</td>
<td>Framesets, frames or iframes</td>
<td>Critical</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>4.</td>
<td>Nested Tables</td>
<td>Critical</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>5.</td>
<td>Pop-up detected</td>
<td>Severe</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>6.</td>
<td>Caching</td>
<td>Medium</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>

#### 6.2.3 Pop-ups

Additionally no pop-ups are detected on any page of department’s mobile website.

#### 6.2.4 Nested Tables

Nested tables were avoided while implementing department’s mobile website.

#### 6.2.5 Caching

To use caching all pages on department’s mobile website uses “CACHE-CONTROL” in `<meta>` tag.
6.2.6 Overall Score

By considering all above points and following the suggestions by W3C mobileOK checker the overall score of landing or index page, web and mobile certification, calendar, faculty and news is 51%, 63%, 63%, 57% and 54% respectively.

6.3 GOOGLE'S GoMo TESTING

The Department's mobile website was tested on Google's GoMo and the results are shown in Table 6.2.

Table 6.2. Google’s GoMo Testing Results for Department Mobile Website

<table>
<thead>
<tr>
<th>No.</th>
<th>Test</th>
<th>Landing Page</th>
<th>Web &amp; Mobile</th>
<th>Calendar</th>
<th>Faculty</th>
<th>News</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Zooming required to read</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>2. Scrolling required to read</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>3. Links and buttons clicked with thumb</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>4. Total Time (Loading + rendering) (seconds)</td>
<td>0.79</td>
<td>0.41</td>
<td>0.46</td>
<td>0.38</td>
<td>0.83</td>
</tr>
<tr>
<td></td>
<td>5. Overall Score(out of 6)</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>5</td>
</tr>
</tbody>
</table>

6.4 RESULT ANALYSIS

Following section shows result analysis of GoMo testing on department’s mobile friendly website.
6.4.1 Zooming and Scrolling

As suggested by GoMo testing tool all pages in department’s mobile website requires only vertical scrolling. Zooming to read the information is not at all required by any of the page.

Figure 6.1 shows department mobile website news and landing page. Zooming or scrolling is not required for reading information.

![Figure 6.1. Department’s mobile website news and landing page. Snapshots taken on July 16, 2012.](image)

6.2.2 Links and Buttons

As shown in Figure 6.1 buttons on landing or index page are clickable by thumbs and fingers on department’s mobile website. Also “Home” button is provided on each page for efficient navigation to index page.
6.2.3 Total time (Loading Time + Rendering Time)
Total time for landing or index page, web and mobile certification, calendar, faculty and news is 0.79, 0.41, 0.46, 0.38 and 0.83 seconds respectively which is increased as compare to department’s desktop website except news page.

6.2.4 Total Score (Out of 6)
Overall score for department mobile website depending on above points for landing or index page, web and mobile certification, calendar, faculty and news is 6, 6, 6, 6 and 5 respectively which is much better than the results for department’s desktop website.

6.3 Result Comparison
W3C mobileOK checker test and Google’s GoMo testing results from department’s desktop website [Section 2.3] and department’s mobile website [Section 6.1 and Section 6.2] are compared as follows.

6.3.1 Total Time (Loading and Rendering)
Total time is loading and rendering time of webpage on mobile browser. With W3C mobileOK checker test total time for landing or index page, web and mobile certification, calendar, faculty and news is 0.25, 0.04, 0.06, 0.06 and 104.24 seconds respectively on department’s desktop website while total time for landing or index page, web and mobile certification, calendar, faculty and news is 0.79, 0.41, 0.46, 0.38 and 0.83 seconds respectively on department’s mobile website. That means total time for department’s mobile website is increased as compare to department’s desktop website. But if we consider the page sizes, use of Jquery mobile framework, design of pages and information on pages of department’s desktop website and department’s mobile website the total time difference is considerable.

Still the time taken to load and render the pages of department’s mobile website is consistent for all pages and it’s below 5 seconds as suggested by Compuware [14] and this is achieved with the help of image compression and scaling down of images while uploading it through Admin Panel, using caching, combining the CSS and using minimize version of Jquery mobile.
6.3.2 Zooming and Scrolling

As suggested by GoMo testing tool website should avoid zooming and scrolling to read the information and if scrolling is not avoidable keep it vertical. Zooming and scrolling both required for department’s desktop website. By using appropriate font size and lay out text size zooming and scrolling is avoided on department’s mobile website. Some of the department mobile website pages Ex. news, calendar where scrolling is not avoidable and it’s kept as vertical.

6.3.3 Links and Buttons

Links and buttons on department’s mobile website are clickable with thumb and fingers which is major problem on department’s desktop website.

6.3.4 Nested Tables and Caching

W3C mobileOK checker suggests avoiding nested tables due to vertical and horizontal scrolling on mobile devices screen and providing caching information to reduce the number of network access which makes it quicker and cheaper to load pages. Nested tables are detected on all tested pages as well as caching information is not provided on department’s desktop website. Department’s mobile website pages do not have any nested tables and caching information is provided on each page.

6.3.5 Total Score and Mobile Friendliness

Total score (Out of 6) from GoMo testing tool considers all the tests i.e. zooming and scrolling required, links and buttons clickable by thumbs and fingers, loading and rendering time for pages. Total score is 6 for all tested pages and 5 for news page on department’s mobile website. While total score is 2 for all tested pages and 0 for news page on department’s desktop website. Mobile friendliness from W3C mobileOK checker considers all the criteria for mobile websites as per W3C mobile web best practices and assigns score. W3C mobileOK checker mobile friendliness for Landing or index page, web and mobile certification, calendar, faculty and news is 5%, 24%, 32%, 31% and 0% respectively on department’s desktop website while mobile friendliness for landing or index page, web and mobile certification, calendar, faculty and news is 51%, 63%, 63%, 57% and 54% respectively on department’s mobile website.
GoMo testing score and W3C mobileOK checker mobile friendliness suggests that department’s mobile website is more mobile friendly.
CHAPTER 7

FUTURE ENHANCEMENTS

7.1 PROFILES FOR STUDENTS AND PROFESSORS

As future employees, students’ profiles on the Department’s website are an important source of information for employers. Also, profiles of professors and their research projects on the Department mobile website would make it easier for prospective students to select classes or professors on the basis of their academic interests.

7.2 MERGING THE DATABASE

By merging the databases of the courses offered by the College of Extended Studies and the Department of Computer Science, a single location for information would be created for current and prospective students on the Department’s mobile website.

7.3 PUBLIC TRANSPORTATION DETAILS

Approximately 11 percent of public transportation users are en route to schools. School districts, colleges, universities, educators, students and parents rely on expanded public transportation services [26]. Adding useful information on public transportation on the Department’s mobile website would make it very convenient for students.

7.3 EMERGENCY CONTACTS

The results from the National Campus Safety and Security Project survey suggest that university campuses are both proactive and systematic in addressing the four phases of emergency management: prevention/mitigation, preparedness, response and recovery [27]. By merging the emergency contact list from the Computer Science Department, College of Sciences and SDSU’s emergency contact list and implementing it can give a click on button to send your last location recorded.
CHAPTER 8

CONCLUSION

Mobile hardware and software efficiency has increased very quickly in recent years and will continue to expand in future years. Regular website design is different than mobile website design, and these technologies do not work on the same UI design patterns. With the limitations of mobile devices’ real estate, it's extremely important to have an efficient interface design on a mobile website in order to provide a user-friendly experience. There is a pressing need for a mobile website for the Department of Computer Science at San Diego State University because the current website is designed for a computer or laptop. An efficiently designed mobile website would increase traffic and provide information in a clear and attractive way to benefit the students, professors and staff of the Department. Such a mobile website would also add a new milestone in the Department’s achievements.

In light of these requirements, this thesis has presented the design and implementation of a mobile-friendly version of the existing Department of Computer Science website and in so doing expects better access and greater satisfaction for all users.
REFERENCES


APPENDIX

USEFUL LINKS
1. Master’s Thesis Project
http://rijeka.sdsu.edu/~manoj