AN INSIGHT ON A MOBILE FRIENDLY WEB

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by
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An Insight on a Mobile Friendly Web

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DEDICATION

I dedicate this thesis to my family who taught me that the best kind of knowledge is the one that is learned for its own sake. They also emphasized that whatever you do, second place should not be an option. I also dedicate this thesis to my friends who stood by me and took immense care of me in my hour of need.
ABSTRACT OF THE THESIS

An Insight on a Mobile Friendly Web
by
Arvind Gopalram Morwal
Master of Science in Computer Science
San Diego State University, 2012

The industrial revolution was a time of change, growth and evolution as technological innovation became the cornerstone by which our society expanded into mass production of infrastructure, transportation and communication. Yet the last 100 years pales in comparison to the rapid implementation and adoption of web technologies, which has taken place in the last 20 years alone. The advent of mobile integration as a widespread standard, and the application evolution this has created is another example of how the demand and consumption of technology is driving the growth of this sector. Audiences that consume the mobile web are forcing organizations and companies of every kind to adopt mobility as the future for marketing, brand recognition, e-commerce and communication strategies to name a few aspects. The advent of social media and the ability to share content as a medium has placed an important emphasis on how the next stages of technological evolution are taking place within our lifetime. The purpose of this study is to investigate the impact of creating a mobile friendly website. Understand how this website drives greater levels of adoption, usage, accessibility and conversion for business and personal purposes. Mobile friendly websites provide integrated features like click to call, GPS mapping along with the capture, processing, uploading and sharing of information, content and media, easily and effectively. By combining the many features that a mobile web-enabled application can offer to any user, the benefits become the hallmark of the experience. Take into account the advances in multi-media interfaces and we can say that the mobile web truly creates a "wow" factor that is addictive, engaging and "sticky." Moreover, the ability to self publish media and retrieve information in real-time has created a forum for making informed decisions with transparency at the core.
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<th>Description</th>
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<tr>
<td>CES</td>
<td>College of Extended Studies. SDSU’s College of Extended Studies offers a wide variety of lifelong learning classes, seminars, and certificate programs. Career advancement courses are offered in many areas of management, leadership, and quality improvement while self-enrichment courses range from astronomy to web design.</td>
</tr>
<tr>
<td>SDSU</td>
<td>San Diego State University. San Diego State University is the largest and oldest higher education school in San Diego.</td>
</tr>
<tr>
<td>HTTP</td>
<td>Hypertext Transfer Protocol. HTTP is the core foundation for data communication on world wide web.</td>
</tr>
<tr>
<td>PHP</td>
<td>Hypertext Preprocessor. PHP is a general-purpose web development scripting language.</td>
</tr>
<tr>
<td>SQL</td>
<td>Structured Query Language. A programming language specially tailored to work on relational database management systems.</td>
</tr>
<tr>
<td>CSS</td>
<td>Cascading Style Sheets. A special type of language that describes the presentation semantics of a document written in a markup language (i.e., HTML, XHTML).</td>
</tr>
<tr>
<td>XML</td>
<td>Extensible Markup Language. A unique and custom markup language that defines a set of rules for encoding the document that is in machine and human readable format.</td>
</tr>
<tr>
<td>AJAX</td>
<td>Asynchronous JavaScript. A web development technique to create an asynchronous request to the server without refreshing the complete page.</td>
</tr>
<tr>
<td>W3C</td>
<td>World Wide Web Consortium. The main organization that maintains and approves the world wide web standards.</td>
</tr>
<tr>
<td>XHTML</td>
<td>Extensible Hypertext Markup Language. It extends the xml rules on the html markup language. This extension makes sure that the document is well formed.</td>
</tr>
<tr>
<td>CDN</td>
<td>Content Delivery Networks</td>
</tr>
<tr>
<td>JS</td>
<td>JavaScript</td>
</tr>
<tr>
<td>ROI</td>
<td>Return of Investment</td>
</tr>
<tr>
<td>ROE</td>
<td>Return of Engagement</td>
</tr>
</tbody>
</table>
GLOSSARY

*Feature Phone*: Feature phones are dumb phones that have advanced features such as a camera or an MP3 player built into them, but not the full connectivity of smart phones. The feature phone is a simple, low-end phone, which does not have the keyboard type keypad and large display screen or other more advanced technologies.

*Smartphone*: Smartphones have advanced features mimicking the full functional power of a PC, such as a large screen, computer like keyboard, big storage capabilities, and the ability to execute applications.

*Touch Screen*: Touch screen phones are those that have a full-function screen on which you can tap, make a click, scroll your fingers to slide icons on the phone, type on the virtual keyboard, use two or more fingers to click and drag items, and pinch to zoom in the images and expand them. The most famous example would be.

*Dumb Phones*: Phones that have all the hardware required for Smartphones but do not have the software to enable the advanced features of a Smartphone like support of features for browsers, touch screen, etc.

*Mobile Web*: Anything and everything on the World Wide Web provided a mobile device could render it.

*Desktop Web*: WebPages designed to view on the web browsers on a desktop computer

Open Mobile Alliance (OMA): The goal of OMA is to set the interoperable mobile data service enablers that work across devices, service providers, operators, networks and geographies. In essence, they want to create mobile web standards, which make the mobile browsing a better world.

*WAP*: WAP is mobile browsing, a process defining how a phone communicates to the network and vice versa. WAP1.0 was limited to WML, but WAP 2.0 does support XHTML and other latest technologies.

*WML*: the first among many programming languages used to design mobile web pages. WML allows information on the webpage to interact with mobile devices. For
example, clicking the phone number on the webpage of WML page causes the mobile phone functions to wake up, kick in, and call that phone number.
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I would like to thank all the people who have helped and inspired me during my thesis study. I am heartily thankful to my advisor Dr. Joseph Lewis, whose encouragement, supervision and support, from the preliminary to the concluding level, enabled me to develop an understanding of the subject. I would also like to extend my appreciation to Professor Roger Whitney (Computer Science Department) and Professor Usha Sinha (chair of Physics Department) for being part of my thesis and showing faith and trust in me, and to Zachary Schenkler for his support and help. Finally, yet importantly, deep thanks to my family whose continued love and support have inspired me to do the very best that I can.
CHAPTER 1

BACKGROUND

Many studies [1, 2] have shown that more and more people are using mobile devices to access the Internet while on the go. In fact, one third of the world's population uses their mobile devices to perform Internet searches [3]. One-half of all Internet searches performed using a mobile device for local products and services. Mobile websites make it easier for on-the-go visitors to find required information or services, contact relevant support with easier and faster options, for calling, email, and get directions. This eliminates the need for extra steps in order to contact or visit the person or website. It makes mobile friendly websites integral to the identity of any organization or business. There have been a number of researchers investigating the significance of mobile friendly websites [2], specifically centered on the impact of being mobile compatible while optimizing the limited space available within mobile design.

Designing the experience of the website around consumer mobile devices and smartphones provides the best experience to a valued user. In this manner, any user browsing a website from their mobile device can easily distinguish between a design targeted to provide a more unified experience and design elements that have not considered the users’ consumption of that website or its personal or commercial purpose on the mobile web. The experience provides for important usability factors, such as smaller screens, native touch gestures, feedback and more.

The most critical task to achieve is providing the best possible user experience to any individual. Among all the application development strategies, user experience requires the highest priority and is often the basis for the general architecture requirements for the mobile website. Ease and effectiveness of completing a task on the website creates an experience for the user. Experience is the most fundamental aspect for any user, but it can become a complicated process for a traditional website when users are trying to access or find information from that property through a mobile device. There is an inherent problem in presenting a regular website on the mobile device. The key points that need attention are a
thumbnail friendly navigation structure, highly visible icons, mobile site redirects, usage of maps, and design accessibility options like device orientation and accelerometer feedback. For example, Figure 1.1 shows a comparison of the Computer Science Department's website as seen through a mobile browser in comparison to a mobile optimized version.

![Existing department desktop website (on left) and department mobile website (on right).](image)

According to the aforementioned key points, if we optimize the mobile design for the school's departmental website, we could present the information in an optimized manner. The intention of the above design is to provide a better way to navigate through the website on a mobile device. Navigating to information, such as Professor’s office hours, Directions to the department, Downloading of relevant application forms, Easy access to department opportunities, Channel to broadcast events and news, Calendar of important dates, Admissions information in the non-mobile friendly version is difficult. It would be ideal if all the information above were available to the students and professors on their mobile devices.
The importance of this data requires generating the optimum pathways to access information and services on a mobile website in comparison to the mobile incompatible version where large sections of webpage real estate are underutilized. To design within the constraints of limited screen size and intelligent categorization of information for easy consumption forces better inherent usability factors as a standard. It creates a better understanding of the relevant information. The result of the analysis should provide us with the most important pages. These pages are available to the user for consumption.

Understanding the experience of an end user is the most important aspect of a mobile friendly website, especially because many mobile users are often engaged in a disconnected act such as driving or talking while using the website simultaneously. A user loses interest in the website if they have to act on inefficient processes with multiple clicks. Thus, a good design will provide easy access to information with a minimum of clicks, reducing the potential for loss of interest. Additionally it will reduce the potential bounce rate and loss of conversion for any given website strategy.

According to a 2012 survey of 2,300 college-bound high school seniors, conducted by the National Research Center for College & University Admissions (NRCCUA), the educational consulting firm Noel-Levitz, and the content management solution provider Omni Update, “Ninety-four percent of students said that they were able to find the information they were looking for on the mobile site and it generated a positive opinion of the school” [4]. A good web experience would raise the inherent interest and trust in an institution and would create a stronger potential following among the student body.

Ninety-two percent said they would be disappointed with a school, or remove it entirely from their lists, if they were unable to find the information they needed on the institution's website. Thus, having a mobile friendly website creates brand recognition that the university is “technically” aware and has a positive impact on the students applying to the university. We can extrapolate the importance for the number of mobile devices accessing any particular website as an indicator of not only traffic and consumption, but how best to engineer that user’s experience.
1.1 SMARTPHONE STATISTICS

Understanding Smartphone statistics is important because if there is a question on whether an app is important or about a mobile friendly website. To answer this question a close research on market shares of all the devices is required.

1.2 AUDIENCE WITH DIFFERENT HANDSETS AND DEVICES

According to Global mobile statistics 2010, Table 1.1 [5-7] gives the top five companies which have a share in the mobile industry.

Table 1.1. Top Five Smartphone Manufacturers

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<tbody>
<tr>
<td>Samsung</td>
<td>94.0</td>
<td>19.1%</td>
<td>22.9</td>
<td>7.5%</td>
<td>310.5%</td>
</tr>
<tr>
<td>Apple</td>
<td>93.2</td>
<td>19.0%</td>
<td>47.5</td>
<td>15.6%</td>
<td>96.2%</td>
</tr>
<tr>
<td>Nokia</td>
<td>77.3</td>
<td>15.7%</td>
<td>100.1</td>
<td>32.9%</td>
<td>-22.8%</td>
</tr>
<tr>
<td>Research In Motion</td>
<td>51.1</td>
<td>10.4%</td>
<td>48.8</td>
<td>16.0%</td>
<td>4.7%</td>
</tr>
<tr>
<td>HTC</td>
<td>43.5</td>
<td>8.9%</td>
<td>21.7</td>
<td>7.1%</td>
<td>100.5%</td>
</tr>
<tr>
<td>Others</td>
<td>132.3</td>
<td>26.9%</td>
<td>63.7</td>
<td>20.9%</td>
<td>107.7%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>491.4</strong></td>
<td><strong>100.0%</strong></td>
<td><strong>304.7</strong></td>
<td><strong>100.0%</strong></td>
<td><strong>61.3%</strong></td>
</tr>
</tbody>
</table>


IDC: Total shipments of mobile devices increased by 11.1 percent in 2011 compared to 2010 [7]; the sale of the mobile handsets was 1,546 million across the globe.

Gartner: Total shipments in 2011 were 1,775 million units up by 11.1 percent compared with 2010. In this quarter, Apple and Samsung increased their combined market percentage share by 16 percent and Nokia’s share dropped to 17.2 percent [5].
1.3 Audience of Different Age Group

The age group from 12-24 is the largest group in the world known for mobile purchasing and usage [8], see Figure 1.2 [9]. Mobile invention has attracted and created consumption among every age group from teens to adults, and anyone can find some aspect of the mobile web appealing, productive, engaging or useful. Kids between eight and twelve have been termed tweens, and there have been numerous studies conducted on the mobile usage trends of tweens. Tweens and teens seemed to have emerged as the next big market for mobile manufacturing and services organizations. The usage of mobile technology and related services is growing rapidly as each new generation of potential mobile users becomes more adept at adopting, using and manipulating increasingly complex systems. In one of the studies done by Srivastava [10] on Japan’s market for mobile phone usage among its youth, he finds that mobile usage is remarkably high averaging at nearly 80%. The females dominate Internet usage over the mobile phone compared to the males. In the USA, mostly teenagers and college students use text services more than actually using voice services [11].

Smartphone statistics help a mobile friendly designer take necessary design consideration to create a familiar design structure for a wider audience of mobile devices.
CHAPTER 2

DESIGNING MOBILE STRATEGIES

2.1 INTRODUCTION: WHAT MAKES THE MOBILE WEB DIFFERENT

The first mobile phone to have Internet connectivity was the Nokia 9000 Communicator, launched in Finland in 1996 [12]. In just 16 years, the number of visits on a website using the mobile Internet has increased tremendously. To give an example, Wikipedia, one of the most content rich sites on the web today, reported that mobile traffic to their website was 10 times greater than PC based access; this ratio hints at the future popularity of mobile friendly websites.

The audience of the mobile web shows over 80% of adults and 60% of teens in the US own mobile phones, and at least 28% of these users have browsed the Internet from their phones [13]. However, a disproportionately low number of consumer-focused websites actually work on WAP enabled handsets.

In order for a site to work on a wireless handset, it should adhere to the website accessibility design guidelines, provided by W3C organization. Mobile handsets use WAP technology to browse the Internet. WAP is a technical standard for accessing information over a mobile wireless network.

Mobile usage is becoming an integral part of the day-to-day life of many people. It leads us to provide a better way of accessing important information on the mobile web efficiently to users. We have to understand that mobile websites often serve a different purpose than those used on laptops and desktops. For example, a student might open his departmental website to find the office hours of his or her professor or to download a document or form from the department. Thus, all these details should be easily available to the user as a forward facing option since there is a limited amount of real estate available on mobile device screens. If students are accessing departmental information more commonly on the mobile version, then standard methods of information architecture may not give the student an intuitive understanding of how to find, consume and utilize the information they
are seeking because mobile browsers will not effectively render full screen content options from the standard browser interface.

2.2 Why It Is Important to Have a Mobile Friendly Website

There is a discussion among different age groups over the user’s attitude towards different features of mobile technology, which mostly depends on how the technology satisfies the organizational and personal needs of that individual. For example, social networking features are more popular in the younger age group. A Deloitte [2, 10] telecom forecast pointed out that within one year, Smartphone sales were expected to exceed sales of all other PCs combined, including notebooks, laptops, and desktops.

The advantages of mobile devices are extensive, which means there would be an increase in the number of mobile devices sold. Cisco predicts there will more than 5.6 billion mobile devices by 2015 [14]. Additionally as per the Cisco's Visual Networking Index Global Mobile Data Traffic Forecast, global mobile data traffic will increase 26% between 2010 and 2015. Approximately 19% of the world’s 6 billion mobile users are already utilizing location-based services with 62% aspiring to do so in the future [15]. As well, mobile devices provide convenience, instant connectivity and ubiquity. Consequently, personalization layers, such as intuitive search features, location identification, calendars and organizers along with Apple's personal assistant Siri are also becoming factors in the mobile experience. According to a Light Speed Research survey, “56% of people believe a mobile version can make the shopping experience more enjoyable” [16], see Figure 2.1 [16]. Understanding a similarly drawn comparison to the impact of mobile technology on the educational institution would be important in gathering the requirements for the mobile experience. Rather than deciding on whether students and faculty members will adopt the mobile device, we should raise awareness by making mobile services available and then examining their effects on traffic, conversion, consumption and interaction. We could examine whether the mobile services solve the problem of students obtaining information from the department and faculty to provide important messaging effectively and efficiently.
Mobile commerce or m-commerce is the buying and selling of goods and services in a wireless environment, such as through wireless devices like cellular telephones and PDAs. Smartphone devices dominate PDA’s, but perhaps the need for the PDA was the basis for the evolution of such technologies as Apple’s Siri. Also called next generation e-commerce, m-commerce enables users to access the Internet without needing to find a place to plug in [1]. Mobile commerce or m-commerce, which is just like traditional e-commerce-based models is rapidly growing and solidifying its position as the next generation of buying and selling goods online [1]. Due to the increase in the mobile e-commerce industry, many companies are creating their own mobile friendly websites. Figure 2.2 [16] shows the breakdown of the market share for mobile friendly website, apps and other forms of m-commerce. For example, mobile-banking, mobile messaging, mobile entertainment, and mobile ticketing are all industries that are adding optimized experiences. Before the existence of mobile commerce, e-commerce required a network computer to connect to the network. This prevents the user from buying or selling (GOODS) goods online [3]. Due to the emergence of
mobile commerce, the consumer or user has complete freedom without the necessity or encumbrances of having to use a computer. The advantage of a mobile device is its extensive reach into the consumer market because prices are more competitive when compared to a laptop or desktop. Combining the convenience of on-the-go mobility and instant connectivity yields a greater adoption rate than a laptop or desktop machine for a broader slice of lower income users.

### 2.3 Apps vs. Mobile Friendly Website

In mobile development, there is the question of whether it is best to develop an application or a mobile friendly website. This question can be effectively answered considering the context of the goal to achieve. For example, if it is an interactive game then developing an app is a good choice because it needs to use many native resources. Conversely, if the goal is to achieve a mobile friendly website for a wide audience supporting multiple devices and screen sizes, then a mobile friendly website is a better option[17].

Benefits of Mobile friendly websites include the following:

- No need to download from the app store. There is no need for user to go and download any software to view the website. All the mobile devices are preloaded with at least one of the many mobile browsers.
- Compatibility across a large number of platforms. As Mobile friendly websites run on the browsers, they are compatible with all the platforms. This benefit alone removes the need of creating multiple versions for different platforms.
- Circulating updates is easier on the website. Mobile friendly websites have the same code base for all the platforms with additional css tags or files specific to different browsers.
- Websites are easily searched using any search engine, and navigating to it is easier to do by users.
- Website links and URLs can be easily shared in social media channels like Facebook, Twitter and many more from blogs or other websites; thus, increasing the ability to share for a website.
- Overall reach of a website is wider since it is on multi platform and can be easily shared.
- Supporting a website is comparatively easier than supporting multiple apps on different platforms.

2.4 DIFFERENCE BETWEEN A MOBILE FRIENDLY WEBSITE AND A MOBILE OPTIMIZED WEBSITE

The structure of a mobile optimized website is different from a mobile friendly website as shown in Figure 1.1. A Mobile Friendly Website is a regular website that works on desktop/laptop, tablet and handheld device. On a mobile device, it will appear smaller, but perfectly functional. A Mobile Optimized Website reformats itself with the optimized design when it is accessed through a mobile or tablet. Reformatting will change the navigation to be “touch” friendly and to have optimized images, reduced graphics, limited type interaction and allow a user to go to the regular website [18].

2.5 IMPORTANCE OF HUMAN COMPUTER INTERFACE IN MOBILE WEB

What is the definition of a Human Computer Interface? HCI is an effort to create an easier interface for users to interact with hardware. Following the principles of HCI creates guidelines towards developing an application that is easy to use, efficient, safe, utilitarian and effectively appealing. Easy to use design should be constructed so that the basic functionality, and even higher level functions, can be accessed, consumed and utilized without the need for a manual. Efficiency can be measured by how quickly users accomplish their goals within a minimum number of clicks, swipes or buttons pushed. Another primary
principle of HCI design is layering safety protocols that intuitively do not allow the user to execute actions that may create undesired results. An example of this may be deleting content or information that is important or even relative to core functional stability. There should be embedded confirmation structures activated through logic that determines the information to be sensitive or required other applications’ actions to be performed. Alternatively, the interface can even offer to recover the last action from either errors or human mistakes. This safety protocol can also extend beyond general deletion by ensuring the personal data of the user is secure and can only be accessed or utilized by applications that have specific permission-based roles attached. Utilitarian design can be measured and defined through providing the fundamental functionality needed for any user to accomplish the specific goals that the application or website is offering. In order to understand the utility there needs to be a requirement analysis of the application or system users. With better navigation design, understanding the user's goal within the applications’ effectiveness can be achieved, and the appeal of a system can be measured through the first impressions generated by the user and the behavior he or she exhibits in satisfaction, time spent surfing the site or capturing general feedback data. A good user interface is attractive and helps to avoid frustration with clear pathways, thus reducing frustration and conveying a sense of productivity and intelligence. Several limitations are inherent in the mobile device, which restrict the user from performing actions that are natively easy on a laptop or desktop machine:

- Manufacturers do not standardize the interface per device.
- Limited screen size
- Input methods are generally basic and the keyboards are difficult to use.

Small displays and limited input methods increase the need for a different user interface that works best with the mobile device [19]. Designing for the mobile device is completely different from designing a website that runs on computers and bigger screens because they have large amounts of real estate, which is limited in the case of the mobile web. It is not just shrinking the existing website developed for computers, but it is actually designing an interface that is easy to use from a smaller screen without using the zooming feature of the handset. Smartphones such as the iPhone display normal websites well on its small screen, but the users still have to work with their fingers to zoom in and zoom out. Users prefer to engage with a site without zooming; this refers to "satisficing" design pattern in "Human
Computer Interface” design patterns for mobile structures [20]. This design pattern is a combination of satisfying and sufficing. We have used a design pattern where a user does not have to learn how to use the interface and can achieve the goal from the action. Therefore, a good designer would present the most relevant information with just a click and would not require the user to engage in heavy typing. The author has implemented this design pattern in creating the homepage UI with bigger icons, which are easy to click on without zooming actions and have clear and understandable text and icons. In order to design a good user interface, some existing guidelines are useful for a developer and ensure development organizations are using the same standards. Some thoughts to consider while designing the website for mobile devices are the characteristics of the targeted user, environment and culture of the user, and the requirements that will satisfy the user.

Some of the major published research on human computer interfaces revealed a number of well-established standards like Shneiderman’s "Golden Rules of Interface Design," which presented guidelines for the usability of the mobile device [21, 22]. Another standard on human-centered design is the ISO standard 13407 [23]. W3C released the Mobile Web Best Practices for multiple mobile devices in 2005 [24]. However, according to Jun Gong and Peter Tarasewich, the design of mobile device interfaces is still unexplored and unproved [25]. Nonetheless, they prove that this gap needs some golden rules of interface design. Interface design for a mobile device was mainly inspired by the desktop application interface design, and modified the disadvantages on a mobile device. In a conference paper, Ayob, Nurul Zakiah and Che Hussin, Ab. Razak and Mohamed Dahlan, Halina proposed design guidelines for Shneiderman’s Golden Rules and best practices for mobile devices, and came up with a three-layered design [1]. These phases also include all the golden rules. This research divides the mobile design into three phases. All the phases are discussed in the Implementation report. The author has used these analysis steps to create a design for the Computer Science Department mobile friendly website.

### 2.5.1 Analysis (Context of Use)

The context is the most important factor for designing the mobile design. The core part of the design consists of information and calls to action for the user. The analysis phase
would consist of discovering the requirements and context of the design elements for the
mobile device.

To identify and document the user’s tasks, the author has done research and analysis
of the implementation of mobile friendly websites in other universities such as Stanford and
MIT. In addition, the author discussed this subject with students in multiple departments of
San Diego State University, such as Computer Science, Electrical Engineering, Biology, and
Business Administration. Questions discussed with the students were as follows:

- How often do you visit your department's website?
- What is your department?
- If your answer was (a) Never or (b) Visited just once, it is because:
- What information are you looking for when visiting the department site? Have you
  visited the department's website on a mobile device?
- Do you prefer browsing on a desktop or a mobile phone?
- Will your visits increase if all the department information is served on a mobile
  friendly website?
- Do you think having a mobile friendly website will help the department establish a
  good recognition among the student community?
- Do you think cutting edge technology and an effective design of the department's site
  will increase interest among the students to apply for courses in the department?
- What content would you want to find on the department's site when browsing on a
  mobile device?
- Do you use mobile phones for social media sites like Facebook, YouTube, Twitter
  etc.?
- Do you prefer mobile phones to computers for social media sites?
- Will it be helpful if social media accounts were linked to the department's site?
- If a department's mobile website gives you a good and easy experience, how likely
  are you to (go back to the site, recommend it to your friends and family)
- How would the mobile friendly site affect your opinion of the quality of the courses
  offered by the school?
- In your opinion, what changes will make the website more useful for you?
- Other input or suggestions?
- These questions and the data from the research of other universities led to the
  identification of the main navigation structure of our website.
In order to identify and document the organizational environment, it is very important to understand this environment and which features are most appropriate to implement. For example, having Google Maps on a web-based e-commerce store like eBay or Amazon is not the most critical feature, whereas the same feature would be important in the case of a university website where a map of different departments is provided with driving and walking directions. This exercise helped the author to identify the core features and navigation structure for the Computer Science Department website as shown in Figure 2.3.

Define the use of the system. The goal of the system is to provide a mobile friendly and mobile optimized website for students, faculty and department.

2.5.2 Design (Context of Medium)

Designing a device may present some opportunity or difficulties that can challenge the developer; thus, the context of the medium is critically important. The implementation of this design is based on Smartphone's and tablet devices. The developer needs to consider how to design a user interface that works on mobile screens of various sizes. This phase deals with how to create a design, which satisfies the needs of the users and their organizational structure:

- Enable frequent users to use shortcuts; this design element deals with "habituation" and "Satisficing" design patterns in HCI. All the important actions should be provided as easy navigation points. The habituation design pattern is for expert users who have dealt with any software for a long time. There should be special keys, hidden commands and macros.

- Offer informative feedback; every action of the design should give a response in some way to show the user that the action has been taken. For example, when clicking a list view there should be a process icon if the results are taking time.

- Consistency is important; maintain the consistency in terms of design structures, color schemes, text, sounds, and identical terminology in different sections for messaging. This gives the user a feeling of "safe exploration." Safe exploration allows the user to explore an interface without suffering any dire consequences.

- Reversal of actions; users should be allowed to change their action back to the last step in most situations. If the undo option is not available in some scenarios, then the user should be asked to confirm the action before it is executed. This design structure is called "safe exploration" in HCI, error prevention and error handling.

- Reduce short-term memory load; this is a design element for interface design, which addresses the notion that humans can only store a certain number of steps and pieces
of information in their short-term memory. Overcome this problem by designing options on the screen that are clearly visible or by using drop down menus.

- Design for multiple and dynamic contexts; there should be multiple layout and design structures for the context of use. For example, an application should have a different design structure for students, faculty and administrators.
- Design for multiple devices; the design should be standardized for multiple devices, such as mobile phones, tablets and kindles.
• Design for speed and recovery; according to sources, a standard mobile website should load in under 5 seconds. Users expect faster results on mobile devices.

• Design for “top-down” interaction; design should follow a hierarchy-based interaction system. This design structure maintains the same standard on smaller screen sizes.

• Allow for personalization; there should be features specific to the different roles of the system. This personalization layer enhances the users’ experience for their respective roles.

• Do not repeat the navigation on every page.

• Clearly distinguish selected items; the user is less confused by the design if it conveys where the user currently is on the website. This can be achieved by using breadcrumbs, last visited option, and highlighting the option in multi-tab interface.

2.5.3 Testing (Context of Evaluation)

For testing, it is very important to understand the intuitiveness of a design for a naïve user. A design can be considered a good design, if the users of the application are able to intuitively understand and predict the flow of the design. The designer needs to fulfill the user’s requirement for ease of access of information, navigation, and structure. Additionally, making sure that the user experiences a level of satisfaction when utilizing the website. If we consider usability to be of high importance, there should be a phase especially dedicated to performing the evaluation of the developed design. This phase would determine whether the design was able to meet the user-based requirements and satisfy that the experience delivered met the expectations. Thus, testing and evaluation are the most crucial phases of the user interface design:

• Usability testing

• Field testing: Field testing should be done with random people trying to use the interface in a real world environment. For example, the mobile friendly website for the Computer Science Department was tested with students from different departments and people from the software industry.

• Predictive evaluation: The key components of the approach are the research and analysis, design of the website, and implementation of an actual mobile friendly website. Prediction values are: Intention (to use), Adoption (actual use), and Impact (the intended results).
2.6 UNDERSTANDING THE PSYCHOLOGY OF MOBILE USERS

Mobile web users are mostly using the web in a distracted mode, which means they are surfing the web while doing some other activity [15]. In most cases, users are utilizing the mobile web to find something quickly; therefore, mobile websites should have a clear navigation structure by making the key information links always available and easily accessible with less screen taps. This information is from the interviews that were held on the campus of San Diego State University.

All the navigation links should be of standard clickable size. The standards according to Apple are 57x57 for low resolution and 114x114 for high-resolution phones. There is an area called "safe zone," which is the margin between two icons. The safe zone has a margin of 5px on the left and 50px on the right and 20 pixels at the bottom, according to Apple [26]. Colors and themes can help to draw attention to the important information.

2.6.1 One or Many Mobile Websites

Mobile handsets are of different screen sizes and processing capabilities. Thus, the website developed for the various handsets, resolutions and screen sizes needs to have a compatible design for best results. This example uses Human Interaction design called "alternative views" to provide access to information in a logical, sensible manner by addressing the user's own choice in a device. It does this by putting the best features, navigation points, highest points of conversion, interaction and engagement into a limited amount of space. Thus, designers have to utilize an intelligent approach to the presentation of information. A best mobile practice is to provide a unified experience, so that the user has a consistent experience delivered to them across multiple devices. In addition, choices for accessing mobile friendly sites or browsing regular web pages are an additional strategy to consider.

2.6.2 Virtual Showcase

The mobile website could help to create a virtual showcase for a user’s business. The salesperson or representative no longer has to carry their laptops; displaying and presenting through a mobile interface can save time and be more effective than carrying around a laptop.
2.6.3 Locations

Designing a mobile website is not just making the content of the regular website smaller and trying to fit it into the smaller screen, rather it is presenting the most important content in the best way in terms of usability, effectiveness, and interactions. In addition, the mobile phone’s core function is to call someone. According to the research and the survey [4] conducted across different campuses, we can infer that the locations, maps and contact points are the most important aspect for the mobile web. If we follow the feedback of the survey [4], this could be considered as a good practice to include the following: locations, maps, social sharing ability on social media like Facebook, Twitter, LinkedIn, YouTube, images and videos, click to call and accessing contacts available in the application. Therefore, an organization has to consider presenting phone numbers, locations, maps and other features for contact purposes if they fit in the context of the organizational environment.

2.6.4 Low Bandwidth Optimization

Bandwidth is a concern in addition to various screen sizes for showing a website effectively and pleasantly on a mobile device in different geographic locations of the world. This plays a big role in displaying different images and multimedia on the mobile device. Because the mobile market is growing by leaps and bounds with billions of handsets in use throughout the world, bandwidth may be a concern for the mobile web. While in major areas of the US connectivity is getting better, the mobile website design should use techniques that load websites to the handset even in low bandwidth areas or plans.

2.6.5 Design Guidelines for Low Bandwidth Support

Use of high-resolution images and multimedia files should be limited on the mobile website. There are other techniques by which the availability of image and JavaScript files can be made available using CDN networks directly from the web as a service. There are many images, JavaScript, and cascading style sheet compression techniques that can be used to reduce the overall size of the resources required for the application. All these techniques are a good start, but the disadvantage of using CDN networks is that the application has to rely on third party availability, creating a dependency. Thus, a good practice would involve using the best of all the techniques, such as including only important resources in terms of
images and multimedia to convey the message of the website and to add to the visual attention. In place of the images and buttons, links or dropdown lists should be used, which work on most of the mobile handsets available.

There should not be any huge multimedia files on the first page of the website, which forces the user to wait for them to load on opening the website. Rather they should be available in the linked pages with an option on the first page. This way, if a user is interested in seeing one of those files, he could navigate to that page. In addition, the system should provide the file size information to the user.

The finest example for this discussion would be the YouTube model, which is the biggest video sharing website to date. YouTube provides the best mobile friendly website because they consider it a priority. They provide an MP4 format, and it is available on most mobile phones. This enables the user to see a video anywhere, anytime. YouTube also takes care of the different bandwidths available by having different formats for the same video in order to deliver the correct format according to the bandwidth available. It gives the best available format in terms of size, for example, for a network that is 3G, and for a lighter one when the bandwidth is low.

2.6.6 Typing Too Much on a Mobile is a Bad Idea

Typing on most mobile devices, even if it is the slickest iphone4, is a bit challenging. Blackberry did a better job with a physical Qwerty structure, but it still is not that effective since the keys are very closely packed. It would be a good idea to put the access of the most important information in the form of a link or thumbnail, which could be easy to understand for the user. In addition, the options should be limited. If they increase, there should be an option to categorize and combine into one thumbnail that could further grow and provide an album of the categorized items. Thus, providing a sequence of options to choose from would be a simple and effective approach for satisfying usability. Important information such as address and contact info should be readily available on the first page or at most, one click away.
2.6.7 Mobile for Video Sharing from Anywhere

One hour of video is uploaded to YouTube every second. Forty-five percent of college students now shoot, send, and receive videos on their mobile devices. Almost half the videos on Facebook and YouTube are uploaded via mobile devices [3]. Thus, videos should be considered in the design strategy for creating the design of mobile devices. Researchers measure time spent using media to determine how popular various forms of media are with the public. As of 2009, college students spent about 2.5 hours per day watching TV, and those same students spent 2.4 hours per day interacting with their mobile phones—texting, calling, surfing the web, listening to music, watching videos, playing games, or using applications [3].

2.6.8 Appreciating Privacy Issues

The mobile phone is a very personal medium for everyone. It knows everything about its owner, including personal contact list, messages, emails, etc. Another example would be GPS that contains information about users’ home, work and current location.

2.6.9 Saving Time with Targeted Searches

The mobile web is still in a continuously changing and improving state. Information and the entertainment world are now connected to the user round the clock. People are turning into fact-checkers. Mobile phones are used to check the facts while shopping about the products, interacting with friends about a course offered in a university, or locating the best restaurants nearby.

2.7 UNDERSTANDING THE CHARACTERISTICS OF MOBILE WEB CONTENT

Mobile content should be designed for meeting the lower bandwidths’ requirements. In addition, the processing power and storage capacity of a mobile device is far less than a computer. Thus, for a mobile website to be efficient and rapidly accessible, it should have a webpage of limited size with a very limited amount of images. Mobile web development requires understanding the characteristics of the mobile webpage structure. This understanding is also important for the development of other features, such as configuring the
network equipment and optimizing web server parameters. In addition, buffer size and allowed number of TCP connections should be considered.

We will now review the history of the three popular mobile web technologies, WAP, WML and XHTML-MP. All these web technologies can be distinguished by the mobile handset that supports them. WAP 1.0 was introduced in 1998 as the first Mobile Web standard [27]. Many companies including Nokia and Motorola teamed up to develop the initial Wireless Application Protocol (WAP) stack. It was envisioned that WAP 1.0 would enable a wide range of devices including mobile phones, laptops and PDAs to send emails and access the Web. Due to the limited resources of mobile devices, a lightweight, and XML-based standard called the Wireless Markup Language (WML) was developed. WML also supports a "deck of cards" feature that allows the Web programmer to aggregate multiple related pages (cards) into a batch (deck).

A study examined different mobile content technology using a crawler to identify whether the web content is for a mobile device or a non-mobile HTML. Once identified as mobile content, the websites were further analyzed for the design guidelines, network usage in terms of connectedness, page sizes, etc. One of the programs used for this purpose was named Larbin, an open source crawler [28]; Larbin is configurable, extendable and customizable for web crawling. Larbin source is in continuous modification mode to get a better result for detecting mobile content. Google web search also allows searching through Mobile web content by markup type, such as WML, XHTML-MP, or C-HTML. Table 2.1 shows the statistics for pages, server and domain with different formats for mobile web and html.

Table 2.1. Statistics for Pages, Server and Domain with Different Formats for Mobile Web and HTML

<table>
<thead>
<tr>
<th>Type</th>
<th>Num. Pages</th>
<th>Num. Servers</th>
<th>Num. Domains</th>
<th>Avg. Pages/Server</th>
</tr>
</thead>
<tbody>
<tr>
<td>WML</td>
<td>1,055,589</td>
<td>13,672</td>
<td>5,734</td>
<td>77</td>
</tr>
<tr>
<td>XHTML</td>
<td>145,314</td>
<td>842</td>
<td>446</td>
<td>173</td>
</tr>
<tr>
<td>C-HTML</td>
<td>14,206</td>
<td>27</td>
<td>26</td>
<td>526</td>
</tr>
<tr>
<td>HTML</td>
<td>227,462</td>
<td>47,110</td>
<td>38,143</td>
<td>5</td>
</tr>
</tbody>
</table>

CHAPTER 3

IMPLEMENTATION

3.1 METHODOLOGY OF CREATING A MOBILE FRIENDLY WEBSITE

In this chapter we will discuss the process of creating a mobile friendly website. There are total six steps that are discussed in detail to provide a complete life cycle of creating a mobile friendly website.

3.1.1 Step 1 Analysis of Climate and Culture in your Organization

The mobile web is increasing in its popularity due to the availability of high-speed wireless networks, advanced browsers for mobile devices and decreasing pricing plans for mobile devices. In addition, there is a lot of work done on mobile friendly websites using markup language (C-HTML, WML and XHTML) to write the web pages specifically for the mobile device [29].

The structural properties of the fixed web have been well-studied [30, 31] and models have been proposed that represent the structure and evolution of the web [32]. In contrast, very little is known about what will ultimately be the best structural properties for the mobile web. Before implementation, one should have a clear understanding of the user’s expectations about the source of interest on the website. One should make careful observations about the activities that a user would do when they open the website. One should review the basic aspects of mobile users by asking: When do they need to access a website using their mobile device; Are they looking for something specific, or directions to a location, office hours, holiday lists, reference books, articles, etc.

In order to develop a mobile friendly website, a designer needs to understand the depth of the above-mentioned points. There is a need to undergo a requirement analysis exercise. The author has created a list of multiple questions to understand the climate and culture for creating a mobile friendly website for the Computer Science Department of San
Diego State University. Questions were asked of students from different departments to understand the core needs of a mobile friendly website and to learn what goals they want to accomplish from their department website, how often they visit the department's website and if providing the mobile experience with social media would increase the number of visits on the website. Table 3.1 lists the questions and possible answers.

### 3.1.2 Step 2 Conducting a Need Assessment

A need assessment is an important procedure, which has to be done before starting a mobile initiative. Need assessments will make the user expectations clear. There are three steps in the need assessment: Planning, collecting-data and analyzing.

### 3.1.3 Step 3 Planning

Need is a relative term since the user and contexts are always changing. One should have a clear scope and period, which will be used as a resource. There should be a clear stakeholder hierarchy as in primary stakeholder and secondary stakeholder.

### 3.1.4 Step 4 Collecting Data

Collecting information for the inputs could be done in several ways depending on the level of mobile website one is planning to design. There are methods, such as One on One meeting, focus group, professionals to collect data, market research, etc.

### 3.1.5 Step 5 Analysis of Data

Once the data is collected and is available, it should be analyzed to see what points are important for the development. The data should be categorized by level of importance. According to the hardware and technology that is suitable for the maximum number of hardware, one should decide on the feature implantation part.

### 3.1.6 Step 6 Analysis of Design

In deciding the technology and features for the web application, the designer should come up with a good design considering the Human Computer Interface part of the application. The application should be easily accessible by all age groups and cultures. The following properties should be considered for design analysis:
<table>
<thead>
<tr>
<th>Questions</th>
<th>Possible Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often do you visit your department's website?</td>
<td>Visited just once&lt;br&gt;Never&lt;br&gt;Once a month&lt;br&gt;Once a week&lt;br&gt;Once a semester&lt;br&gt;Other</td>
</tr>
<tr>
<td>Departments</td>
<td>MBA, Biology, Computer Science, Physics, Electrical Engineering</td>
</tr>
<tr>
<td>Reason if just visited once</td>
<td>I get all the information I need from the teachers&lt;br&gt;I usually don't go online&lt;br&gt;It's not up-to-date information&lt;br&gt;Other</td>
</tr>
<tr>
<td>Will your visits increase if all the department information is served in a mobile friendly website?</td>
<td>Yes&lt;br&gt;No&lt;br&gt;Maybe</td>
</tr>
<tr>
<td>Do you think having a mobile friendly website will help the department establish good recognition among the student community?</td>
<td>Yes&lt;br&gt;Don't Know</td>
</tr>
<tr>
<td>What content will you want to find on the department's site when browsing on a mobile device?</td>
<td>Academic program listings&lt;br&gt;Cost/ Scholarship calculators&lt;br&gt;Academic Calendar&lt;br&gt;Specific details about enrolled courses&lt;br&gt;Online application forms&lt;br&gt;Faculty information</td>
</tr>
<tr>
<td>Do you prefer mobile phones over computers for social media sites?</td>
<td>Yes&lt;br&gt;Don't Know</td>
</tr>
<tr>
<td>Will it be helpful if social media accounts could be linked to the department's site?</td>
<td>Yes&lt;br&gt;May be</td>
</tr>
<tr>
<td>If a department's mobile website gives you a good and easy experience, how likely are you to go back to the website</td>
<td>Very Likely&lt;br&gt;Likely&lt;br&gt;Neutral&lt;br&gt;Not Likely&lt;br&gt;Not at all</td>
</tr>
<tr>
<td>How will the mobile friendly site affect your opinion of the quality of the courses offered by the school?</td>
<td>Positively&lt;br&gt;No Effect&lt;br&gt;Negatively</td>
</tr>
</tbody>
</table>

(table continues)
Table 3.1. (continued)

<table>
<thead>
<tr>
<th>Questions</th>
<th>Possible Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you use mobile phones for social media sites like Facebook, YouTube, Twitter, etc.?</td>
<td>Yes  No  Sometimes</td>
</tr>
<tr>
<td>Do you think cutting edge technology and an effective design of the department's site will increase interest among the students to apply for courses in the department?</td>
<td>Yes  No</td>
</tr>
<tr>
<td>In your opinion, what changes will make the website more useful for you?</td>
<td>More information about the department  More educational materials  More audio/visual content updated more often Better design Better design Other</td>
</tr>
</tbody>
</table>

Comments

- Context of the mobile website (User’s expectation):
  - Goals of the visitor
  - Why users are accessing your website at a given point in time
  - Point of interest in the website for users
- Features:
  - Ability to make a phone call since they are using a mobile device
  - Mobile devices have uncomfortable keyboards, thus there should be minimum keyboard interaction.

All the above steps were used in the implementation of the Computer Science Department's mobile friendly website for San Diego State University. The need assessment discussed the issues with the current, prospective, and former students of the department of Computer Science and other departments, such as Physics and Electrical Engineering. The major goals of the students, according to the research conducted by the author, were these: to find office hours of the professors, get details about the courses, view departments photos, stay informed about calendar events, find job postings within departments, navigate to different professors’ websites from one common interface, view maps of the department buildings, get walking directions, download and print all types of application forms that are available in the Graduate Department, socially interact and forward information about courses and the department community on social sites like Facebook, Twitter and LinkedIn.
This research focuses primarily on the importance of having a mobile friendly version of a website and understanding the best practices in implementing these standards. This research also includes a study conducted in the Computer Science Department of San Diego State University, which concluded that mobile usage has become an integral part of the day-to-day life activities for many people. The number of users and their emotional attachment to a mobile device will guide us in creating a set of best practices for mobile web deployment. If standards are established and utilized, this can provide a better way of providing relevant information, applications and media effectively and efficiently on the mobile web. Therefore, the study was focused on understanding the emerging need of a mobile friendly website and the impact of immediacy, satisfaction, and engagement. The author has undergone the requirements analysis and the needs analysis through various researches available from multiple sources [4], and has created a list of questions that can be used to do an analysis with the students of different departments located within San Diego State University. The key points extracted from this research included the following:

1. There is a need for a different experience among mobile users, and a design incorporating the best features should be provided as an integrated offering on the mobile device.
2. There is a debate between using an application or a mobile friendly website. According to studies [4, 15, 16] and surveys [4], mobile friendly websites are used more often than downloading an app.
3. Mobile friendly website creation should follow a development life cycle and the recommended standards as mentioned in the different sections of chapter 3.
4. The mobile friendly version should be synchronized with the standard website.
5. The most important phase of website implementation is the testing phase. As there are many devices with various screen sizes and operating systems, the application needs to be thoroughly tested against multiple standards for presentation and usability.
6. Social media is a channel that can increase the total experience of a website. This does not suggest creating a single fan page on Facebook, rather it should be considered as a means to update, communicate and interact to increase potential ROI (Return of Investment) and ROE (Return of Engagement).

### 3.2 Technology Used

The author, based on the findings, designs and best practices discussed in this thesis, has developed the mobile friendly version of the Computer Science Department website, using widely accepted mobile technologies in web development for mobile devices. The
author has gone through the above mentioned 3.1 Methodology of Creating a Mobile Friendly Website exercise to gather the information for all phases of the implementation and worked to create all the designs and select the technology to implement the mobile friendly website. The technology used to create the mobile version of the website includes Jquery mobile framework, HTML5, CSS3, JavaScript, googlemaps, php5, and MySql. The decisions on technology, design and the features were made by the author. The details of each technology and its usage are provided below.

3.2.1 Jquery Mobile

Jquery mobile is a HTML5, CSS3 and JavaScript based framework that allows development of a mobile friendly website for multiple mobile device platforms with a consistent look and feel across the board. Jquery mobile describes its features,

It supports vast majority of almost all modern desktop, Smartphone, tablet, and e-reader platforms. In addition, feature phones and older browsers are supported because of our progressive enhancement approach. We are very proud of our commitment to universal accessibility through our broad support for all popular platforms. There are 3-level graded platform support systems: A (full), B (full minus Ajax), C (basic). [33]

Jquery mobile is based on a very sound foundation of Jquery and Jquery UI foundation. The core of the Jquery mobile is very effective, easy to understand and implement. Jquery mobile is a lightweight framework with the flexibility to implement multiple themes, and it also provides a wide range of inbuilt themes.

3.2.2 HTML5, CSS3 and JavaScript

HTML5 and CSS3 is the future of web development [34] as forecasted by the gurus of web engineering. Almost all of the web browsers in their latest releases have adopted it. HTML5 is the latest version of Hypertext Markup Language, which was pioneered in the late 80s. Initially, it started with a very rudimentary application of describing document structure and cross linkage of documents. It has been a long journey from there, and HTML found two best friends JavaScript and CSS to work with it and provide a better way to share information across the web. The key difference that is noticeable in HTML5 is the introduction of new semantics, such as header, footer, article, section, etc., to organize the data in a more efficient way. The responsibility is divided efficiently between HTML for the page structure,
JavaScript for the behavior and CSS for the look and feel. The downside of HTML and CSS3 is the browser support. Almost all browsers support the HTML5 and CSS3 except the Internet Explorer.

3.2.3 Google Maps

Google Maps has a range of tools that helps anyone with a Smartphone having GPS capability to know where they are, where they want to go, and what options they have to reach their destination. When you use Google Maps, you are never lost, provided your Smartphone battery is not completely drained. Google Maps provide API for almost all Smartphones to take the benefit of their extensive reach across the globe from a street view to a satellite view.

3.2.4 PHP and MySql

PHP is an open source, widely used dynamic tool to create dynamic and interactive WebPages. PHP is a server side scripting language. It is similar to other server side scripting languages like ASP.NET, and JSP. MySql is a database server. MySql is also open source, available for free download and widely used for small and large application development. PHP and MySql both are cross platform and can be developed on one platform and deployed on another platform. For example, an application using PHP and MySql can be developed on the Windows platform and deployed on the UNIX platform

3.3 FEATURES AND BENEFITS

Smartphone usage is rapidly increasing among different age groups not only in higher education institutions like San Diego State University but across the globe. Smartphones have become an integral part of most people's lives. This project has endeavored to enhance the benefits of an awesome gadget like the Smartphone by providing relevant information, which combines the mobile technology of the web with the influence of the standards and guidelines of Human Computer Interface concepts. In this version of the application, we are providing the following features that would be available to the faculty and students to enable them to be more organized and efficient in finding information from the department website without having to perform several zoom-ins and zoom-outs. In addition, this website will not only motivate users to spend quality time on the department website looking at the ongoing
theses of senior students but will also provide a clear path of how a thesis is pursued, which will ultimately reduce the advising time of professors in answering obvious questions.

Information in the demo application is retrieved from a dummy database once the application is approved for use on the department website. Here are the benefits:

- There will be well organized information of the entire department with a minimum of one to a maximum of three clicks, depending on the importance of the information.
- New students will never get lost on the campus while searching for the department; they will have a powerful map tool that will direct them. Fig 4.16 shows a preview of the map available in the mobile friendly version.
- Increase the traffic to the department website. According to research conducted in multiple institutions including Stanford University and MIT University, a majority of students responded that they would be more likely to visit the departments’ websites and would recommend them to friends and family if they had a better experience on mobile devices.
- Students will be well aware of ongoing events of the department. Social media sharing would increase the students’ engagement on a social level with their friends and other students in the department and across other departments. It will not only increase the prospects of any ongoing or future events but will also create a buzz for discussions and interaction among the student community. Social media features are not currently implement on the implementation website.
- Using social media to like and share the content on the department website takes the maximum advantage of the social media to share the information with everyone and not restrict this information to students or professors.

User impact will vary based on the type of data the user wants to access via a mobile device. For most students, it will be a great tool to find the office hours, send a quick email to advisors and professors, stay up-to-date with current news and events of the department, and download and print the department application forms. Other tasks, such as gathering information about different programs available in the department and bookmarking important dates, obtaining the latest job opportunities available from the department and external internships can be performed. The website provides a medium for students to share the internship opportunities, which will keep the students motivated to visit the department website. All the above features except the student sharing functionality are implemented in the mobile friendly version.

### 3.3.1 News and Events

The latest news from the Computer Science Department including postings of department events, job possibilities, scholarship and ongoing research have been displayed in
the mobile version of the website. The author has used a list-view design for the implementation of the news section. There are three subsections: News, Calendar and Problem of fortnight; a challenge question asked on the website. All the subsections would be rendered into mobile friendly text and images. Images would be rendered above the articles. The Calendar would have a list of all the registered activities such as the thesis defense date for the students with a link to the abstract of their thesis. Events specific to the Computer Science Department such as “Bits and Bites,” (a social event for computer science students and professors to interact and share their thoughts outside of class in a non-formal manner) will also be displayed on the website. Figure 4.3 and 4.4 show a preview of the news and events on the mobile friendly version of the Computer Science website.

### 3.3.2 Faculty

The Faculty page is divided into four sections: full-time, part-time, staff, and emeritus. On selecting the first level of navigation, the user will get a list showing details about all the professors in the respective group. Details include name, email-id, office number, phone number and a view of my website (optional). Email id, phone number and view of my website is linked to the action of opening an email client of the device with the email address pre-populated. When a phone number is touched, it will open a notification with an option to call the selected number or cancel. On selecting the call option, the phone application on the device will make a call for the user. Finally, when “view my website” is clicked, it will route the user to the selected professor’s website.

### 3.3.3 Admissions

The Admissions section displays all the information for applying to the Computer Science Department of San Diego State University for undergraduate, graduate, and certification under the program of extended studies. These three options in the list-view take the user to the relevant pages of the Undergraduate program and Graduate program page on the San Diego State University's website, and the Certification option redirects the user to the College of Extended Studies website for the information on the Computer Science Department. Due to the restriction of different databases of each college, the author cannot unify the data relevant to computer science in one place.
3.3.4 Web and Mobile Certificate Program

The Web and Mobile Certificate Program option provides information related to the courses available in the certificate program with the description about course, faculty, timing, email of the professor teaching the course, and class number. “View full site” option takes the user to College of Extended Sciences, which, has all the information regarding the courses related to computer science and all other departments. The users can share this page with their friends using email and social media like Facebook and Twitter, and add it as a bookmark and in the reading list.

3.3.5 Students Info

The Students information page is the most important page for the students in all categories, which are undergraduate, graduate and certification. It provides information under each category. In Graduate options is a list of four sub-options: thesis, defense, master's exam and advisors. In “About,” students is information regarding the graduate program. The Thesis Defense option gives information regarding the defense process and a to-do list for the thesis. Master's exam gives a list of exams that are going to be conducted. The Advisors List item will give a list of advisors with the same format of details as in the faculty menu. The Undergraduate section has the list of programs, degree requirements and advisors. Degree requirements provide all the information for the undergraduate degree requirements. The About and Advisor list items are the same as the graduate category. The Certification category provides sub-options about the GIS course, employment opportunities and requirements. This certification is for the San Diego State University's Computer Science Department certification. It includes GIS certificate, information about which is provided in the requirement sub-category.

3.3.6 Opportunities

This is a new option, which is not part of the Computer Science Department website now. Here, the author wants to create an opportunity for companies to publish internship opportunities for students of the Computer Science Department directly so that there is maximum visibility of any opportunity for students. It is very hard for companies to find the
right candidate for an internship. Currently, we have an option to upload the pdf file of the requirement, which could be shared with the students.

### 3.3.7 Forms

The Forms page provides a list view of all the forms, such as application, academic, Graduate Assistantship, Research Assistantship, Teaching Assistantship, etc., to download and print. This way a student does not have to go to different locations to download and view different types of forms.

### 3.3.8 Maps

Interactive maps for GMCS, Library and all the parking spaces. We are using Google Maps with JQuery mobile to show the interactive maps. The service for maps is a free service provided by Google. It offers different types of views like map views, satellite views and street views. We are also integrating the directions for the maps where a user can input the start and destination, and the service will provide a list with the directions.

### 3.3.9 Contact Us

Contact Us provides the contact details of all the personnel working in the Computer Science Department. It has links to the developer's page about the abstract of this project. There is also a send feedback button to send any feature request to the developers.

### 3.3.10 On Going Content Assessment

It is clear from the preceding sections that in addition to previously existing content on the "computer science" department website, the author was able to envision a number of additional things that might be useful for students and faculty. The author has tried to cover all the possibilities. This project can be further explored by:

- Understanding all the possible enhancements listed in the research, and interviewing the users of the tools on the website to find out what kind of tools they would like on the website
- Creating a new future enhancement that is not provided in this research. It should be followed by understanding the current process.
- Future enhancement should follow the structure in such a way that the website is scalable and flexible enough to accept further enhancements.
CHAPTER 4

FUTURE ENHANCEMENTS

4.1 Shout Box

Shout box is a feature to which a student, for instance, can subscribe to be notified for a class from a list of courses offered in a given semester. Students can subscribe using the course number, professor name and course category from six areas. On selecting the course, the student's information is registered under the professor's "shout box notifications" list. The professor can send a notification to the student according to the course number. All the notifications would go directly to the student's phone instantly. In a similar fashion, shout box can be used for any sort of notifications.

4.2 CPT Letter Application and Tracking

This feature would be created to help automate the process of getting a Curriculum Practical Training (CPT) letter application from the advisor. Using this feature a student can request a CPT application letter without visiting the advisor's office. The student has to fill out an online application form, which has very minimum information, and choose from a pre-existing drop down list. On submitting the information, the student will be given a unique identification number for their application. The professor will get a notification email with the details of the student and a link to take action. The professor will print the letter using that information and mark the status of the request as completed on the unique link provided in the email. It will notify the student to collect the letter from the Graduate Department.

4.3 Alumni Section

Students who complete their degree requirements are automatically transferred to the alumni category. Alumni can get all the information and updates on the subscription level s/he decides on their profile. Alumni can post job openings, information about their company and other relevant information to the department on their profile.
4.4 Online Appointment Request

Students can request an appointment with an advisor or a professor outside of their office hours. Students can see the existing appointments for the day of all professors and their availability. Professors can attach documents to the appointment, which need to be referred to at the time of the appointment. Notices and updates on the appointment can be sent by students and professors. There are existing calendar tools that support this functionality. There is nothing wrong in building a website that leverages these external tools.

4.5 Profiles of Professors and Companies

Companies can post their job openings directly to the department with the skill sets required and students could apply directly for the job with the recommendations of the professors. Consultants make substantial money just referring the right candidate for the job. If we could have a pool of trusted companies, which need the computer science students, the department could have a new source of funding.
CHAPTER 5

CONCLUSION

The future is mobile! Mobile web has a vast audience from all age groups—tweens, teens, and adults. Mobile web has found a niche in a variety of audiences by making their lives easier through various means. Moreover, due to an increase in the mobile e-commerce industry, mobile-banking, mobile messaging, and mobile entertainment, the mobile web has become an integral part of most people’s lives, as it is really simple and instant to use. Due to the emergence of mobile commerce, a user gets complete location freedom. The advantages of mobile devices provide instant connectivity and an extensive reach; they are convenient, personal, and ubiquitous. Thus, there is a pressing need for students and professors of any university to have their department and college website mobile friendly. According to my research, it is extremely important to have a mobile friendly website for the Computer Science Department of San Diego State University. I am very confident that it will not only increase traffic to the department website, but it will also help students extract the information they need while enjoying a great experience. This experience will bring a "wow factor" to the Computer Science Department website.
REFERENCES


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