

Responsive Web Design

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Abstract - Due to the rapid development of the IT industry, there are many different devices for accessing the web, desktop computers with a wide range of screen dimensions. Hence, there is a need for adapting the web content layout for different screen dimensions and resolutions. Responsive web design is a modern technique for that purpose. This paper will discuss how to use Media Queries, Bootstrap responsive navigation, and layout of streaming technology to achieve responsive web design. And make a rational analysis about responsive web development at the present stage.

Key Words: Responsive, Flow layout, Media Queries, Bootstrap

1. INTRODUCTION

Due to the evolution of techniques and communication devices in the past decade, anyone can easily surf around the web using a PC, mobile phone, tablet, television, game console, etc. All these devices have the ability to access to the internet, and have their own screen dimensions and use different resolutions. Hence web designers should take care that the content of their website is readable and functional on all these resolutions. Design and Development of the web page should make an appropriate response and adjustment according to user's system platform, screen size, screen orientation and so on. That means no matter what screen size of the device is being used, we should be able to switch the page resolution, picture size and related scripting capabilities automatically, so as to adapt to different devices.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

According to Jeffrey Zeldman, responsive design is a technique that designers use to deliver elegant visual experience regardless any browser size used and any constraints lied on accessing device. A design is considered to be responsive if it uses these three points: a flexible grid, flexible images and media, and media queries. By using media queries, website designers can define certain resolution ranges as conditions to use certain CSS definitions called fixed breakpoints. That way, the designer can match which CSS definition will be applied to a given resolution that will create better visual experience to the website users.

According to Cerejo, information quality of a website can be observed through 3 of 12 mobile user experience aspects, namely: functionality, information

architecture, and content. A website's functionality should be informed from its homepage; therefore we observed home functionality later on this research regarding to the functionality aspect. According to Frank Farris, responsive design on mobile device creates a website that needs less user interactions (scroll and click) than nonresponsive website does on mobile device to accomplish the same goal. The benefit of responsive web design is said so because a website which can adapt its layout to browser's size should be able to adapt font's, pictures', and other component's size so that user can read the whole content without doing any horizontal scrolling to see hidden parts of website. Total click caused by mistakes should be decreased because responsive website is actually designed to create comfortable UI and handle limited size of mobile browser.

By considering the purpose and benefit of the responsive web design, we posit the following hypotheses:

H1: There is a significant difference of home functionality quality between different designs on different devices.

H2: There is a significant difference of information architecture (navigability) quality between different designs on different devices.

H3: There is a significant difference of content readability quality between different designs on different devices.

H4: There is a significant difference of enjoyment of using website between different designs on different devices.

H5: There is a significant difference of total scrolls used while exploring home functionality between different designs on different devices.

3. CURRENT SITUATION ANALYSIS

Linear approach is followed by most of the web pages. Most Web pages used a design method called "waterfall model". It starts with analyzing the system requirements, and then set out to design the front-end and background, finally evaluate and implement. Linear nature is the main feature of "waterfall model". Sequential procedure is applied throughout the development.

A. Advantages of Responsive Design

1. Super Flexible-

Responsive web design sites are fluid, meaning the content moves freely across all screen resolutions and all devices

2. Excellent User Experience-

While, content is king and discover ability of content are foremost success metrics, it is the user experience that enables visitors to consume content on any website through the device of their choice and preference, anytime.

3. Cost Effective-

The advantages of having a single site that conforms to the need of all devices are significant when compared to having two separate websites. One website costs less than two, and the savings can be substantial. Sites designed solely for mobile device traffic don't offer the advanced navigational techniques found in traditional websites, and they also require the user to maintain two separate web addresses for your site.

B. Limitations of responsive web design

At this point, RWD is not quite perfect; there are several issues to be resolved, including making the image responsive. The current practice for making the image responsive is to scale it to fit the viewport with max-width: 100%, or possibly to hide it with display: none when the image is not needed. The problem with this practice is that it only alters the image presentation on the surface, while the actual image on the HTML document remains unaffected. This means that the users will still be downloading the same image resolution with a larger size regardless of their device and viewport size, which will result in wasted bandwidth consumption and could also hurt website performance particularly for mobile users. In recent years, responsive design's application rate are low to large portal or e-commerce websites. Because the basic principle of "responsive design" is giving users same content even on different devices (such as deleting some content on low resolution devices). And there are so many single web pages on large portal or e-commerce websites. When reducing on low-resolution devices as well as ensuring the content can be browsed by whole, the page will be stretched inevitably, increasing the difficulty of browsing.

4. THEORETICAL BACKGROUND

A. Responsive Web Design

Designing a website for flexibility and adaptability is called Responsive Web Design (RWD). The RWD term was coined by Ethan Marcotte, a freelance web designer, in May 2010 in an article "A list Apart". RWD is a contemporary website design and development paradigm. It is a principal that focuses on optimizing a website so that it is flexible, adaptive and provides superior user experience. It enhance a websites with best possible viewing experience, smooth content reading and navigation with reduced panning, scrolling and resizing regardless of screen sizes on various devices. This approach leads to design that is simple and

responds to the user's behavior and environment based on the screen size, platform and orientation.

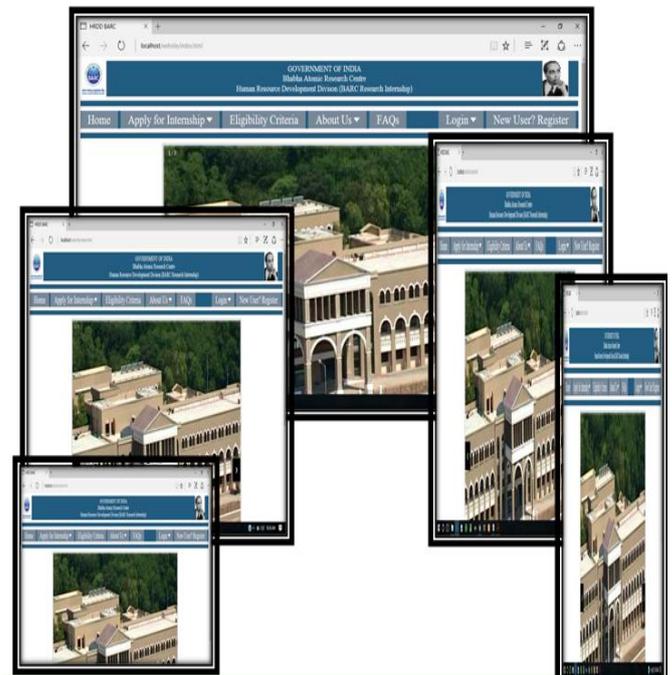


Fig. Responsive web page for various screen resolution devices (HRDD BARC Web Portal)

There are various advantages of choosing a responsive design approach instead of the traditional design approach where different versions are created for different devices. Developing a responsive website is expensive in the beginning but it eliminates the need to create several versions for mobile and other devices. This is rewarding in the long term financially and in terms of time spent to manage the website. Use of mobile devices to access the internet is rising exponentially which implies it is a wise approach to design websites with RWD. Since RWD enhances user experience and the users can easily find the content that they are looking for, the users will not be deviated from the website.

B. IMPLEMENTATION

In order to design a responsive website, a developer has to take different design aspects into consideration. This paper discusses the use of the Media Queries, Bootstrap responsive navigation, and Flow layout (defined web content width by percentage) and other technologies to achieve responsive web design.

First, we should introduce a line of code to the head tag:
`<meta name="viewport" content="width=device-width, initial-scale=1, maximum-scale=1, user-scalable=no">`

This is a description of the viewport, most mobile browsers will enlarge the width of the HTML page's view(viewport) to

comply with the screen resolution. Use meta tag to reset the view. Here the setting means that using device's width as view width and prohibiting the initial scaling width. Default scaling is 1.

1) Media queries :

A designer must use HTML and CSS Media queries to assign different style sheets depending on browser window size. It is used to tailor a website up to a specific range of output devices without changing the content itself.

If a terminal's resolution is less than 980px, the code is:

```
@media screen and (max-width: 980px) {};
```

If set a views which are compatible with iPad and

iPhone , the code is:

```
/**iPad**/
```

```
@media only screen and (min-width:768px) and (maxwidth:1024px){}
```

```
/*iPhone*/
```

```
@media only screen and (min-width:320px) and (maxwidth:767px){}
```

2) Fluid grids:

Grids are the simplest, strongest and quick way to create page layouts. It enables the content of the site to resize and rearrange itself as the percentage based width of a webpage grid expands or contracts. Thus it targets the width of user's web browser to determine how much space is available and how it should display all the contents.

When a user narrow the browser window , often find that a part of the contents in the original page can not be displayed in the browser. To view this part, users need to operate the horizontal or vertical scroll bar that appears in browser. This not only causes inconvenience to browse the web, but also have difficulties in printing on different sizes of paper. There are two key points of flow layout: first, all involved DIV modules in the layout are set to float: left; Second, widths are expressed by percentage. For example, we defined a CSS rule: `div#content {width:70%;}`. That means div # content width is 70% of the width of its parent element. Thus, when the browser window is resized, div # content width will change.

3) Flexible images:

A responsively designed website would always display images at the right resolution for the target device. RWD automatically changes.

4) Bootstrap responsive navigation:

Bootstrap, launched by Twitter , is an open source package for front-end development . It is also a CSS / HTML framework. Bootstrap offers an elegant specification of HTML and CSS , which is written by Less , a kind of dynamic CSS language . The response navigation which developed on the basis of the bootstrap, is a small JavaScript plugin and only 1.7KB after compression, we can create switchable navigation for the small screen. It supports touch screen and CSS3 transition effects, with very good performance. And it also supports transition from height: 0 to height: auto, which is rarely achieved in CSS3 transition effects.

First, setting in CSS:

```
html , body{min-width:1333px}
```

It will set the minimum width of the page as same as the users' device own resolution, so the page will not deform. Min-width is the property of CSS2, so compatibility is good.

Then, CSS responsive documents haven't joined the default of Bootstrap, so it should be introduced into the header file on the basis of <meta> have been to:

```
<link href="assets/css/bootstrap-responsive.css" rel="stylesheet">
```

So that, in this way, we can use bootstrap to achieve responsive navigation.

Making examples according to above method are as follows:

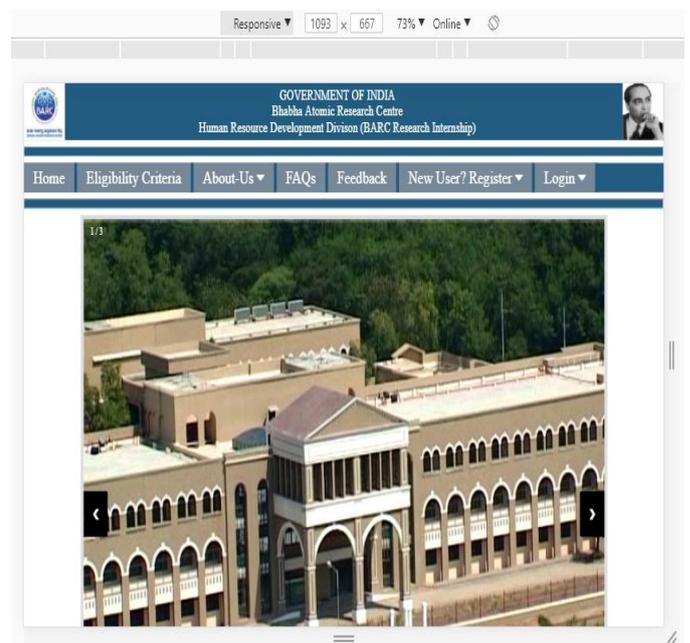


Fig. PC 1093*667



Fig. iPad Pro 1024*1366

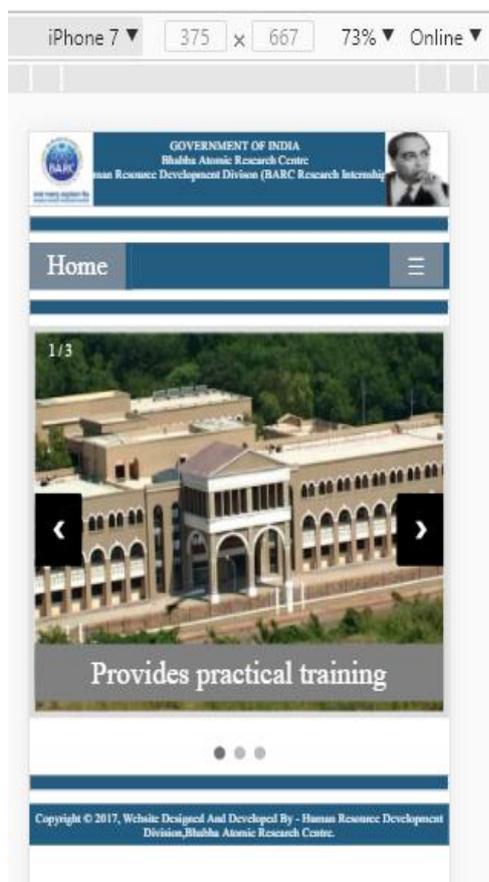


Fig. iPhone 7 375*667

5. BROWSER COMPATIBILITY ANALYSIS

In order to achieve responsive web design, it's inevitable to discuss compatibility issues about HTML5, CSS3 and Bootstrap on the client browser. Our analysis mainly focus

on the world's three major browsers: Chrome, Internet Explorer and Firefox.

TABLE 1. TABLE TYPE STYLE

	Chrome	Firefox	Internet Explorer	Opera	Safari
Android	Y	Y	N/A	N	N/A
iOS	Y	N/A	N/A	N	Y
Mac OS X	Y	Y	N/A	Y	Y
Windows	Y	Y	Y	Y	N

Y- Compatible, N-Non-Compatible, N/A-Non-Applicable

However, some CSS3 and HTML5 properties can not show good compatibility on Internet Explorer 8 and 9. For example:

TABLE 2. CSS PROPERTY COMPATIBILITY

CSS Property	Internet Explorer 8	Internet Explorer 9
border-radius	N	Y
Box-shadow	N	Y
transform	N	Y
transition	N	N
placeholder	N	N

Y- Compatible, N-Non-Compatible, N/A-Non-Applicable

In addition, in order to support Media Queries, Internet Explorer 8 need coordinate with Respond.js.

Bsie, a kind of IE6 compatibility library belongs to Bootstrap, make up the pity that caused by IE6 incompatibility issue. Currently, Bise support most properties of bootstrap on IE6, but there also have some properties that couldn't support. Bise Usage: First, introduced CSS file to <head> tag, and then introduced Bise CSS patch file:

```
<link rel="stylesheet" type="text/css" href="bootstrap/css/bootstrap-ie6.css">
<link rel="stylesheet" type="text/css" href="bootstrap/css/ie.css0">
```

Finally add JavaScript file and Bise JavaScript patch file to the end of HTML document.

Overall, responsive web which used Bootstrap to achieve usually have better compatibility for browser.

6. CONCLUSION

Responsive web design is certainly a convenient solution for various types of websites. It is indeed a lot of work when it comes to development. But if your website is simple, logical, and has a lot of information that cannot be modified for

mobile users – this is the right choice. First, set your website goals for both mobile and desktop version. Only with clear purpose you can make a decision whether to go for a responsive web design or separate mobile web.

As same as web design in the past, a project's specific circumstances (such as budget, target users, and site uses) determine its way of implementation. According to the experiences we already have, if your budget is limited or not feasible to develop a mobile website, comparing with standard fixed-width design, responsive design always provide a better and non-discriminatory users' experience .

Following the principle of giving priority to moving, the first interface is usually designed for mobile devices and then make PC as an extension. So, mobile terminals don't load extra resources, don't redraw the pages of different style in PC terminals, which may affect the performance of the PC.

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