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Responsive Web Design and Its Impact on User Experience

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Abstract: *The introduction of smartphones and the ability to access the Internet on them altered how people use the Internet. Nowadays, a lot of individuals visit websites on their mobile devices. However, because the Web content on the devices varies in size and the navigation of the pages is also different in the various devices, the different screen sizes of these gadgets have some impact on the experience of their users. The introduction of the responsive web design philosophy changed the layout of web sites and how people see them on various devices.*

Keywords: Responsive Web Design, Smartphones

I. INTRODUCTION

The Web is a special medium that challenges designers to relinquish control over their surroundings. The user can alter elements including colours, forms, and layouts. Without knowing in advance which web browsers will be used, the technological platform on which the application will run, such as operating systems, user preferences, resolution of the access devices, and the characteristics and speed of the Internet connection, web designers must conceptualise web applications. Responsive Web design, which enables a website to adjust to the device where a page is being accessed, is one of the most well-liked strategies.

Additionally, people today use a variety of devices, including laptops, netbooks, smartphones, tablets, and other embedded computers in cars and other household appliances. Every day, new devices are added to the Internet. More and more people are adopting tiny gadgets to browse the web. It's interesting how these gadgets' screen dimensions and resolutions vary. The viewports differ from one another. Mobile devices, such as cell phones, have smaller viewports than desktops and laptops. Given that the size of their varied contents varies, these features affect both the viewing and experience of users as well as the browsing behaviour of these devices.

The responsive web design was introduced to solve the experience of the users to view the webpage according to their screen size, and the webpage should be aligned in such a way that its functions should be accessible on any resolution.

The rest of the paper is divided into three categories: Evolution of Web Technology

II. LITERATURE REVIEW

According to Jeffrey Zeldman, designers utilise responsive design as a way to create beautiful visual experiences independent of the size of the browser being used or the limitations of the accessing device. If a design incorporates a flexible grid, adaptable pictures and media, and media queries, it is said to be responsive. Website designers can specify specific resolution ranges as requirements to employ particular CSS definitions known as fixed breakpoints by using media queries. In this manner, the designer can match which CSS definition will be applied to a specific resolution in order to improve the website users' visual experience. Cerejo asserts that three of the twelve components of the mobile user experience—functionality, information architecture, and content—can be used to gauge the information quality of a website.

According to Frank Farris, a website with responsive design on a mobile device requires less user interactions (scroll and clicks) to complete the same task than a nonresponsive website does. The advantage of responsive web design is that a website that can adjust its layout to the size of the browser should also be able to adjust the size of the fonts, images, and other components so that users can read the entire material without having to scroll horizontally to access

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hidden portions of the page. Because responsive websites are made to produce comfortable user interfaces and work with the smaller screen sizes of mobile browsers, the overall number of clicks brought on by errors should be reduced.

III. EVOLUTION OF WEB TECHNOLOGY

Web 1.0, also known as Syntactic Web or Read-Only Web, was the original version of the internet and it was used from 1990 to 2000. Users were only allowed to read content that was created by other people. The user or consumer is not given the chance to give feedback to the content creators. Static websites and personal websites are examples of Web 1.0.

The Web 2.0 era, which spans from 2000 to 2010 and continues now, is also known as the Social Web or read-write Web. It is characterised by websites that enable user-to-user communication. In the modern era, any person can create material, and it is shared and circulated throughout websites. Popular Web 2.0 applications include Facebook, YouTube, Flickr, Twitter, and others. Web technologies like HTML5, CSS3, and JavaScript frameworks like ReactJs, AngularJs, and VueJs, among others, empower entrepreneurs with fresh concepts that encourage user participation on the Social Web. Web 2.0 is designed with the user in mind; producers only need to create tools that will enable and engage users.

The Web 3.0 period (2010 and after) refers to the web's future and is also known as the Semantic Web or read-write-execute. These days, thanks to artificial intelligence and machine learning, machines are able to comprehend data similarly to humans. can support the intelligent creation and dissemination of helpful material adapted to a user's specific needs. As shown in figure 1.

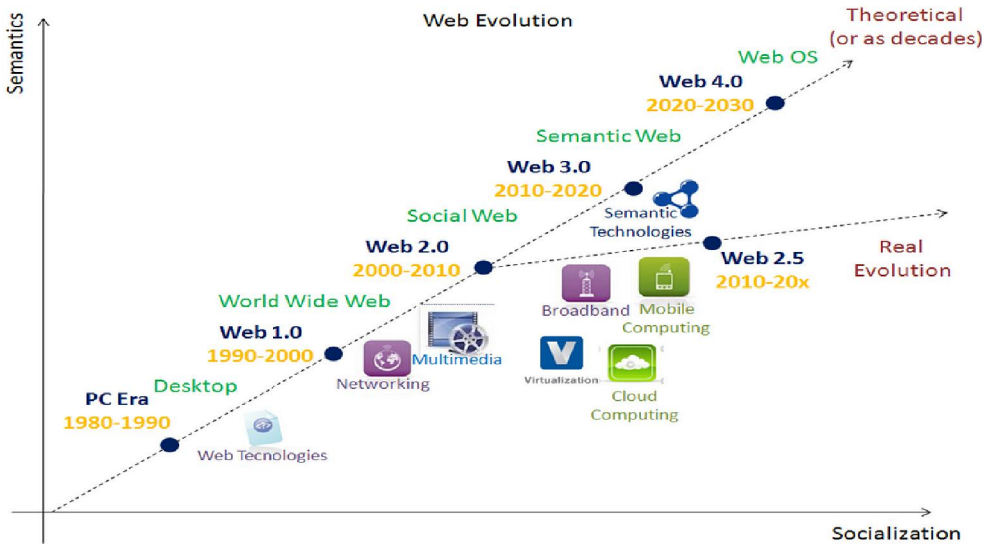

FIG 1: Evolution of Web Technology
Source:http://www.mdpi.com/futureinternet/futureinternet-04-00852/article_deploy/html/images/futureinternet-04-00852-g001.png

3.1 Introduction of Responsive Web Design

Ethan Marcotte first created and defined the term "responsive web design" (RWD) in 2010. Later on, he published a book on the subject. Regardless of screen size, resolution, platform, or orientation, this new paradigm paves the way for designs to respond to users' behaviour and environment. RWD is a group of methods used at the layout level to enable a website to adjust to any device or screen width.

Its goals are to:

(i) adapt the layout to different screen sizes, from large desktops to small phones;
(ii) resize images to suit the resolution of the screen;
(iii) serve up lower bandwidth images to mobile devices;

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(iv) streamline page elements for mobile use;
(v) hide non-essential elements on smaller screens;
(vi) provide larger, finger-friendly links and buttons for mobile users; and
(vii) detect and respond to mobile features.

The three main components of responsive web design are adaptable images, a fluid grid structure, and CSS3 media and media queries. These characteristics enable RWD to respond to all screen sizes and be device independent. The e-Ebola Awareness System's design and development utilises RWD. As shown in figure 2

Fig 2: Representation of Responsive Web Design
Source: https://sympli.io/blog/benefits-and-fundamentals-of-responsive-web-design

The following are some notable benefits of responsive web design:

1. Automatically resizes content to the screen so that it is comfortably legible on every device in order to broadca st material across multiple devices at once.
2. The content can be reduced if required. For example, if we have some function/features that are only useful on desktop and not on mobile devices so we can eliminate those features.
3. As there are no extra modifications that are required in the mobile websites therefore it saves time of the developers.

IV. IMPLEMENTATION

A developer must take into account various design elements when creating a responsive website. In order to accomplish responsive web design, this article explores the usage of Media Queries, Bootstrap responsive navigation, Flow layout (determined web content width by percentage), and other technologies.
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; to accommodate the screen resolution, the majority of mobile browsers will widen the width of the HTML page's view (viewport). To clear the view, use the meta tag. Here, the option denotes using the width of the device as the view width and forbidding initial scaling width. Scaling starts at 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:

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@meadia screen and （max-width：980px）{}；
If set a view 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

The quickest, easiest, and strongest method for making page layouts is using grids. It enables the website's content to adapt and rearrange itself as a webpage grid's percentage-based width grows or shrinks. In order to decide how much space is available and how to display all the items, it focuses on the width of the user's web browser.

When the browser window is shrunk, the user frequently discovers that some of the contents of the original page cannot be seen in the browser. Users must use the browser's horizontal or vertical scroll bars to access this portion. This makes it difficult to print on different sizes of paper and makes it uncomfortable to browse the web. The flow layout has two important components: first, all DIV modules that are involved in the layout are set to float: left; and second, widths are represented as percentages. As an illustration, we specified the CSS rule div#content "width:70%;". This indicates that the content width of div # is 70% of its parent element's width. Therefore, div # content width changes as the browser window does.

V. BROWSER COMPATIBILITY ANALYSIS

Discussing HTML5, CSS3, and Bootstrap client browser compatibility issues is a necessity for achieving responsive web design. The three most popular browsers in the world—Chrome, Internet Explorer, and Firefox—are the principal subjects of our investigation.

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: Not Compatible, N/A: Not Applicable

On Internet Explorer 8 and 9, several CSS3 and HTML5 characteristics, however, may not work well. For instance:

Table 2. CSS Property Compatibility

CSS Property	Internet Explorer 8	Internet Explorer 9
Box-radius	N	Y
Box-shadow	N	Y
Transform	N	Y
Transition	N	N
placeholder	N	N

Additionally, Internet Explorer 8 must work with Respond.js in order to support Media Queries. Bsie, a type of IE6 compatibility library that is a part of Bootstrap, makes up for the inconvenience brought on by the IE6 incompatibility problem. The majority of bootstrap properties are currently supported by Bise on IE6, but certain attributes are not. Use of Bise:

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First,introduced CSS file to <head> tag, and then introduced Bise CSS patch file: <link rel=”stylesheet” type=”text/css” href=”boostrap/css/boostrap-ie6.css”><link rel=”stylesheet”type=”text/css”href=”boostrap/css/ie.css0”>
The HTML document should then have the JavaScript file and the Bise JavaScript patch file added. Overall, Bootstrap-based responsive websites typically have superior browser compatibility.

VI. IMPLEMENTATION ON DESKTOP WEBSITE

Figure 3 shows the outcome of the desktop website deployment. The CSS3 grid system was employed to create the layout of the current design. A layout that is identical to the original design proposal was produced by defining the required number of columns, rows, their sizes, and the sizes of the row and column gaps. When the viewport size changes, the flexible grid system scales the content. The fr unit is one of the grid system's key advantages. No particular measurements are required because CSS automatically divides the columns and rows.

Fig 3: Implementation of website on desktop
Source: https://hackaday.com/2022/10/27/a-collection-of-websites-that-look-like-desktops/

VII. IMPLEMENTATION ON MOBILE WEBSITE

The physical dimensions of the mobile device are taken into consideration during the creation of the mobile website. One can claim that the desktop first strategy was employed as the implementation is based on the previously displayed desktop website. The work in this section consists of a new media query. It takes after the design of the tiniest desktop. Only the sizes of the boxes are different from the desktop ones in terms of appearance and placement. With display: hidden, properties like the title and descriptive text are omitted.
Compared to earlier designs, the year is written in a larger typeface on each box. In figure 4, the mobile site's outcome is shown
Given that the screen's DPI is roughly the same, the resolution effectively controls the desktop layout. Due to their wide range of resolutions and DPIs, the same technique does not function on mobile devices. Physical size, which is determined by dividing resolution by DPI, is what we seek. However, CSS does not allow for the calculation of this. Lists of media queries with a variety of resolutions that identify various mobile devices are the only remaining solution. Making this list is not simple, but lists of media queries for common devices are available in certain sources, and these lists were used in this implementation.

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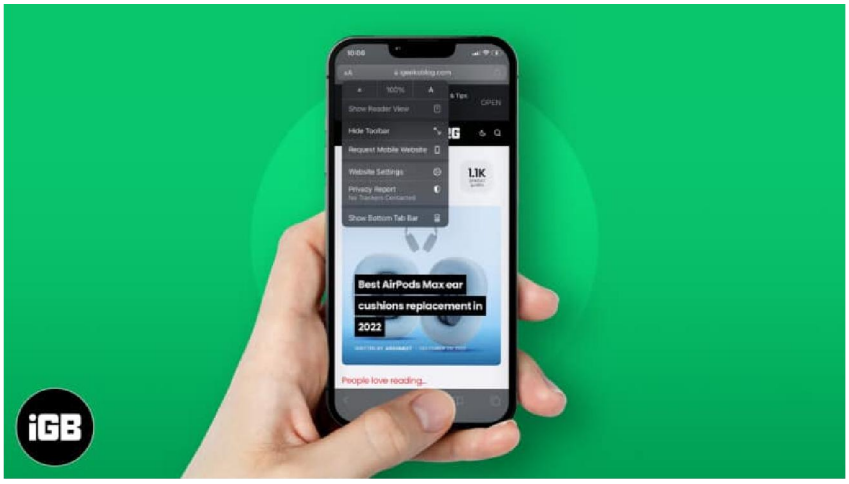

Fig 4: Implementation on Mobile Device
Source: https://www.igeeksblog.com/how-to-go-back-to-mobile-site-after-requesting-desktop-version-on-iphone-ipad/

VIII. CONCLUSION

Undoubtedly, responsive web design is a practical solution for many kinds of websites. When it comes to development, there is a lot of work involved. However, this is the best option if your website is straightforward, logical, and contains tonnes of information that cannot be altered for mobile consumers. First, decide what you want your website to do on both desktop and mobile. You can only choose between a responsive web design and a distinct mobile site if you have a clear understanding of your objectives.

The way a project is implemented is determined by its unique conditions, much as web design in the past. According to our prior experiences, responsive design always offers a better and non-discriminatory user experience than fixed-width design, even if your budget is restricted or it is not practical to construct a mobile website.

In accordance with the maxim of giving precedence to movement, mobile devices typically receive the first interface design attention before the PC is included as an extension. As a result, mobile devices don't load additional resources or redraw pages on PC devices in a way that could slow down the PC

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