Design and Implementation of Fisheye Effect on Tree Menu and Linear Menu on Web Based Interfaces

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ABSTRACT: Computer menus are so important that you find them in virtually every website or piece of software you encounter, but not all menus are user friendly. In both computer applications and websites, users rely on menus to find content and use features. Most users of computer software and internet are familiar with navigating through different types of menus such as linear menu, pie menu, tree menu, fisheye menu and so on, as used to represent the files and directories on their computers. Selecting items from menus is a well-studied area and menu design has become quite standard with well grouped menu items in consistent locations using common names, but with the introduction of the Web and web applications, it is becoming increasingly common to use menus for selecting data items, as opposed to selecting operations. This study was carried out to implement the fisheye effect on linear menu and tree menu on web based interfaces to enhance the identity and looks of the menus. The web pages comprise of tree menu and linear menu of which a fisheye effect was applied to each of the two menu types to make four menus, (tree menu, fisheye tree menu, linear menu, fisheye linear menu). The research carried out and described in this experiment, has helped to gain more understanding about which menu design type may be better.

KEYWORDS: Tree menu, Fisheye tree menu, Linear menu, Fisheye linear menu, Fisheye Effect.

I. INTRODUCTION

Menus are so important that you find them in virtually every website or piece of software you encounter, but not all menus are user friendly. In both computer applications and websites, users rely on menus to find content and use features (Nielsen and Li 2017). Most users of computer software are familiar with navigating through different types of menus such as linear menu, pie menu, tree menu, fisheye menu, mega menu, hierarchical menu and so on, as used to represent the files and directories on their computers (Murano and Khan 2015). Therefore, helping users navigate with ease through these menus should be a high priority for almost every website and applications.

Computer Menu at a Glance

A computer menu is defined as a set of options displayed on the screen, where the selection and execution of one, or more of the options results in a change in the state of the interface (Kenneth and Nancy 1997). Margaret (2007) Defines computer navigation menu as a set of options presented to the user of a computer application to help the user find information or execute a program function. (Budiu 2016). Described menus as list of options in a graphical user interface (GUI). They can be either visible ("menu bars") or expandable (where list of options are exposed when a menu handle is clicked or tapped). The menu handle can be a label, an icon, or both. Internet Explorer menu bar and File menu as indicated in the example below is an example of expandable menus. The File menu is an expandable menu hidden under the handle "File." The menu option selected may further be expandable to display a submenu.

Figure 1: Internet explorer menu bar (left) and file menu (right)

Menu panels usually consists of a list of options, the options may consist of words or icons, the word or icon is not an arbitrary symbol but conveys some information about the consequences of selecting that option. The total set of options is usually distributed over many different menu panels that allow the system to prompt the user with options that are likely to be useful. However, layering the options across many menu panels also requires the user to be able to navigate among panels in order to find options that are not available on the current panel (Kenneth and Nancy 1997).

Menus are common in Graphical User Interfaces (GUIs) such as Windows. Menus are also employed in some speech recognition programs. In a graphical drop down menu, clicking on an item (text, word, button or icon) causes a list of new items to appear below that item. An example can be seen by clicking on one of the text words such as "File" or "Edit" in the horizontal list at the top of the screen in a Windows application. Clicking on an item in the menu executes the indicated function or generates another menu. In a variant of the drop down menu called a fly out, the list appears to the side of the clicked item. A pop-up menu appears above the clicked item when the main list is at the bottom of the window or screen. A menu may occasionally appear with apparent spontaneity at a random location in a window. This type of menu, also known as a pop-up menu, is usually meant to forestall a potential problem or prevent a user from making a mistake. A pop-up menu with only two choices, such as Yes/No, is called a dialog box. Pop-up menus should not be confused with pop-up ads that are used in some commercial websites (Margaret 2007).

Menus are used for exploring and selecting commands in interactive applications. They are widespread in current applications and used by a large variety of users. As a consequence, menus motivate many studies in Human Computer Interaction (HCI). Facing the large variety of designed menu techniques, it is difficult to have a clear understanding of the design possibilities, to understand the advances as well as to compare existing menu techniques (Bailly et al., 2009).

Menu Design Types
There are several types of menu design, some of which are briefly described below:

Mega Menu
Mega menus are a type of expandable menu in which many choices are displayed in a two-dimensional dropdown layout. They are an excellent design choice for accommodating a large number of options or for revealing lower-level site pages at a glance (Nielsen and Li 2017). Mega menu are extremely efficient when you have a long list of subpages and menus. If large list of menu is presented as a single, top-seated menu, then things would get pretty cluttered. But with a mega menu, every major option is visible at one time, so no scrolling or panning necessary

The mega menu can be vertical or horizontal, depending on your design preferences and industry. And additional menu options can be revealed when you hover, click, or tap. This allows for a more engaging and expansive menu system (Ye 2019). A mega menu can be beneficial for many types of websites, even a small magazine blog but mega menu is more suitable when building a large website with multiple categories and subcategories. Mega menus have the following characteristics:

- Big, two-dimensional panels divided into groups of navigation options
- Navigation choices structured through layout, typography, and (sometimes) icons
- Everything visible at once i.e. no scrolling
- Vertical or horizontal form factors when activated from top navigation bars; when activated from left-hand navigation, they might appear as mega fly-outs
- Menu options revealed on hover, click, or tap

Two dimensional menus have many column menus which gives a clear outline of the multiple columns and options available on a webpage and it also enables the user to select his/her required item easily with less effort. The main advantage of this two dimensional menu is that it reduces the effort of scrolling down the list whenever there are many items under a menu (Bigby 2018).

Figure 2: mega dropdown menu.

Mega menus provide sufficient space for images and other rich content. Images in the mega menu can help users select the right option. As shown in the two examples above (Bowman et al., 2002). Mega menus also allow designers to show multiple levels of the site's information architecture

(Nielsen and Li 2017) also argued that, mega menu works better than regular dropdown menus for bigger sites with many features; regular dropdown menus typically hide most of the user's options**.** Though, you can scroll, but it's a pain, and scrolling hides the options at the top of the menu. As a result, you can't visually compare all your choices, you have to rely on short-term memory and messing with short-term memory reduces the user's ability to accomplish tasks on the website. Mega menus show everything at a glance, so users can see rather than try to remember.

Pie Menu (Radial Menu)

A pie menu (radial menu) is a type of menu which can be used for navigation purposes on a website or application. Such a menu can have the same functionality as a linear menu. A pie menu, with degrees of variance, can be similar in appearance to a pie chart used in a typical spreadsheet application (Murano and Khan 2015).
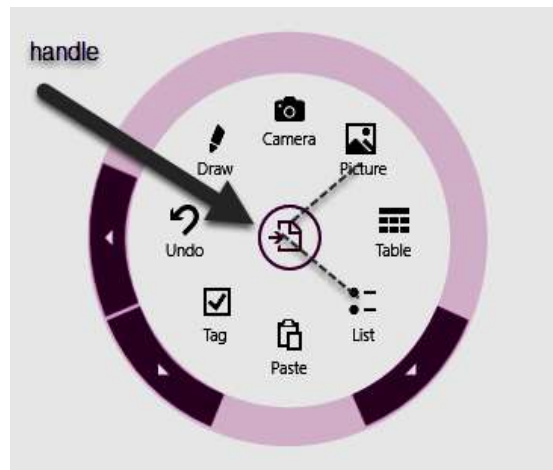
Figure 3: Pie Menu (Radial Menu)

Linear Menu

They are generally used to guide the user in selecting his choice through a sequence of menus. That is when the user selects a particular choice, this choice results in another menu which in turn leads to selecting another choice. While ordering a pizza we order according to the size of pizza, the thickness of the base, the type of sauce and the type of cheese. These are all examples of linear menu sequences.

Figure 4: Pizza Hut linear menu.

Such menus can be used for shopping websites. When a user visits a shopping website and he wants to shop shoes. The user is first prompted to select shoe size which ranges from (6 to 10, 11-20, 21-30, and 31-40 respectively), color and design.

Tree Menu

A tree menu is a menu type that follows a hierarchical structure of data presentation. It enables you to categorise data items based on the type of tasks, products, and functions etcetera. A tree menu has three primary elements, they are named based on the relationship they have with the other elements of the table:

1. **Parent:** parent is a page or record that has subgroups under it.
2. **Child:** a child is a subgroup of of a parent element
3. **Siblings:** two pages that are subgroups of the same parent item are called siblings, they are on the same level in the hierarchy

All the elements can be associated with multiple terms. If a child of one parent node has subgroups of its own, it is a parent to those subgroups and vice versa. Figure 4 illustrates a simple tree menu
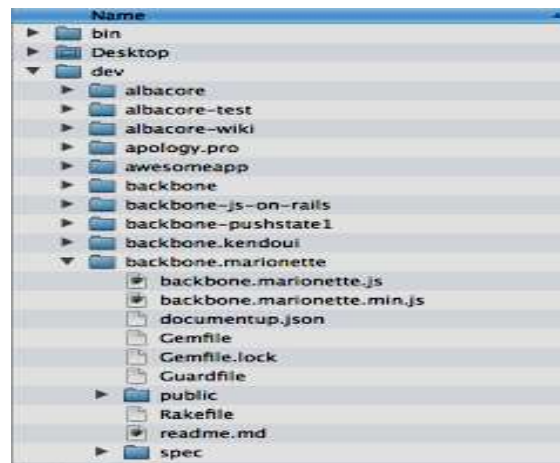

Figure 5: Tree menu

Fisheye Menu

Fisheye menus apply traditional graphical visualization techniques to linear menus. This provides efficient mechanism to select items from long menus. In fisheye menus, all of the elements are always displayed in a single window that is completely visible, but the items near the cursor are displayed at full size, and items further away from the cursor are displayed at a smaller size. Fisheye menus dynamically change the size of menu items to provide a focus is around the mouse pointer. This makes it possible to present the entire menu on a single screen without requiring buttons, scrollbars, or hierarchies and that makes it to become a prominent example of fisheye interfaces, often mentioned as a successful application of the fisheye concept (Kasper and Morten(2007).
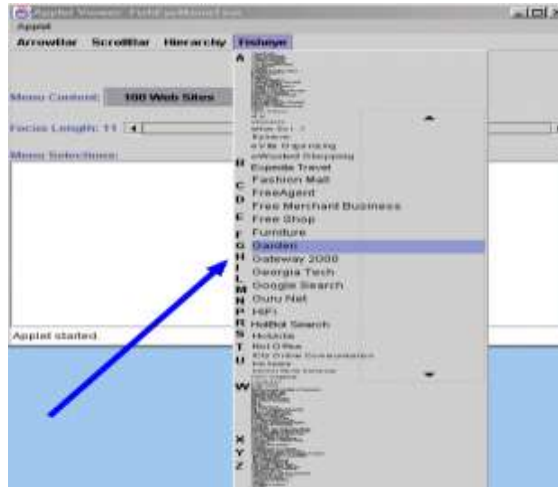
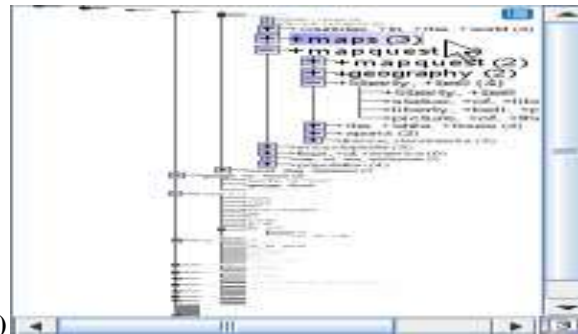**Figure 6: fisheye menu**

Figure 7: Iconic fisheye menu

Fisheye Tree Menu

Fisheye Tree Views are novel applications of the well known fisheye distortion technique. They facilitate the exploration of the hierarchy trees associated with clustered graphs. Tominski, et al., (2016) presented interactive visual aid to support the exploration and navigation of tree menus, this includes Fisheye Tree Views. Tominski, et al., (2016) also described Fisheye Tree Views as visual interfaces to tree menus. The simplicity of these interfaces opens up the possibility of using them for a variety of daily tasks.

(A)

(B)
Figure 8: differently zoomed Fisheye Tree menus (A) and (B).

II. MATERIALS AND METHODS

This research work provides web based interfaces which allow the user select and access menus of their choice. The interfaces were however designed using PHP, JavaScript, MySQL and Bootstrap

PHP: This is the sever side scripting language that was embedded in the HTML and was used to manage the dynamic contents, databases and session tracking, of the developed software.

MySQL: This was the relational database management system that used for storing the data about the projects and information about student.

JavaScript: it was used to build some of the interfaces.

Bootstrap: This is an open-source CSS framework that was used for the development of responsive interfaces.

For the purpose of this study, two web based interfaces containing two each of the linear menu and the tree menus were developed. There were four items on the home screen and seven tasks for each of the items stated for the experiment. Each of these was designed to simulate a typical registration procedure where a user may be asked to fill in a bio data and some other information. The tasks were further designed to ensure that the participants had to use the navigation bar to select options peculiar to them on the sample web site. They were to also record the time they start and finish each item

The four items were as follows:

- Tree menu
- Fisheye Tree menu
- Linear menu
- Fisheye linear menu

The tasks were as follows:

- Task 1: select your gender
- Task 2: select your age range
- Task 3: select your employment status
- Task 4: select your marital status
- Task 5: select your nationality
- Task 6: select your state of origin
- Task 7: select your local government

Software Requirement

As earlier stated in previous subsection the program is design with PHP as a scripting language and My SQL as the Database.

1. Windows XP and above
2. Dreamweaver 5.0
3. XAMP 5.4
4. A web browser

Hardware Requirement

A complete computer system is required to use program software.

The hardware specification is a complete system with the following specification

1. Pentium lll Intel processor and above
2. 2GB of Ram (Random Access Memory) and above
3. 40 GB of hard disk Drive and above

III. RESULTS AND DISCUSSION

The application is installed into the computer then the ip address of the web application is typed into the address bar of a web browser and then enter key is pressed. Once that is done, the first interface that appeared is the welcome screen.The welcome screen contains a brief welcome address and start button. The user clicks the start button to begin the use of the application. By clicking the start button it moved to the home page as below

The home page contains five menu links which the user will click one after the other. If the user clicks the first link it takes him/her to the corresponding page. If the user clicks each of the links on the home page it opens sample form peculiar to the link heading where the user select the option applicable to him /her for the purpose of the experiment. The items or tasks to be completed by the user are : Gender, Age range, Status, Marital status, country, state and local government. In all of

the list above, the user select the one peculiar to them. All the tasks in each of the menu links on the home page are the same for all of the menu types, only the position and style of the list were different.

For tree menu, it follows a hierarchical structure of data presentation. It enables you to categorise data items based on the type of tasks, products, and functions etcetera. i.e take a look at the hierarchy of nationality followed by state and then lastly local government. tree menu has three primary elements, they are named based on the relationship they have with the other elements of the table, nationality is the parent, state is the child while local government is the sibling. Figure 10 illustrates a simple tree menu.

Figure 9: sample tree menu form for Nationality, state and local government

For fisheye tree menu, it followes the same hierachical structure as in tree menu, only that a fisheye effect is applied to the menu list such that when you hover on a particuler menu item it increase the magnification of the item. Figure 11 illustrates a simple fisheye tree menu.

Figure 10: sample fisheye tree menu form for Nationality, state and local government

For linear menu, They are generally used to guide the user in selecting his choice through a sequence of menus. That is when the user selects a particular choice, this choice results in another menu which in turn leads to selecting another choice. While filling a bio data, we select the firstone; gender to the last one; local government and from the first selection it takes us to the next selection up to the last selection. Figure 12 illustrates a simple linear menu.

Figure 11: sample linear menu form for marital status

For fisheye linear menu, , it followes the same procedure as in linear menu, only that a fisheye effect is applied to the menu list such that when you hover on a particuler menu item it increase the magnification of the item. Figure 13 illustrates a simple fisheye linear menu.
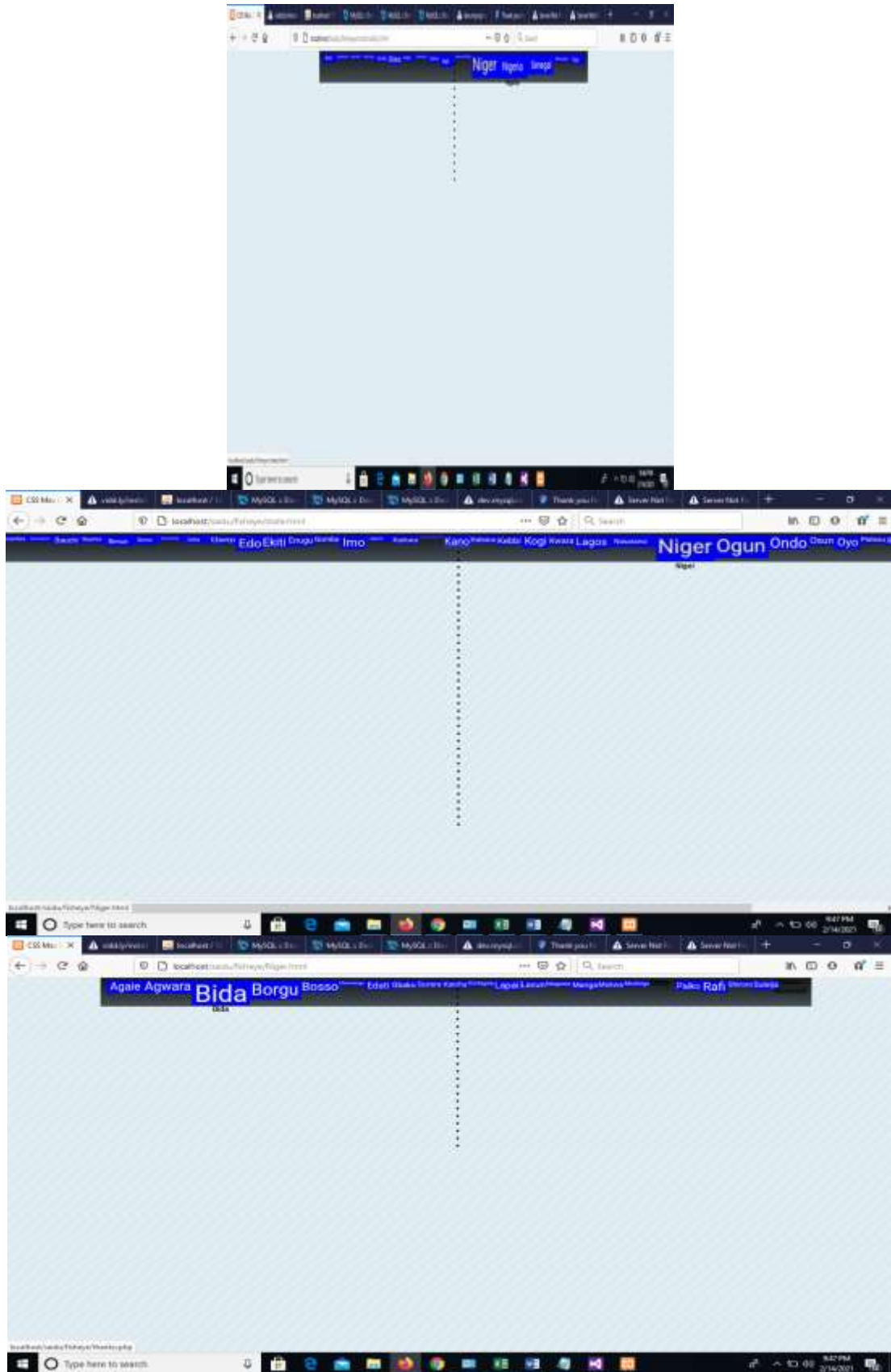
Figure 13: sample fisheye linear menu form for Nationality, state and local government

IV. CONCLUSION

Most users of computer software and internet are familiar with navigating through different types of menus such as linear menu, pie menu, tree menu, fisheye menu and so on, as used to represent the files and directories on their computers. Computer menus are so important that you find them in virtually every website or piece of software you encounter, but not all menus are user friendly. In both computer applications and websites, users rely on menus to find content and use features. Selecting items from menus is a well studied area and menu design has become quite standard with well grouped menu items in consistent locations using common names, but with the introduction of the Web and web applications, it is becoming increasingly common to use menus for selecting data items, as opposed to selecting operations. The research has helped to gain more understanding about which menu design type may be better. Fisheye effect on the conventional menu design types like linear menu and tree menu has improves its look and appears more appealing to users as it draws the attention of the user to a particular menu item that is hovered. The authors would therefore suggest that using menus with fisheye view would go a long way to helping in having web pages that are universally designed.

Furthermore, it is felt that this study helps to increase our knowledge regarding menu and navigation design, more work could still be done to make things more clear. Some examples include investigating further other menu design types and other menu configurations. The authors hope to be able to engage in further studies around these contexts.

This study was limited to a linear and tree menu, other menu type may be considered for further research. It is recommended that in future research, the impact of fisheye effect on mega menu and overview menu should be investigated.

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