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Using TRIZ to Improve Navigation in GUI

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Using TRIZ for Improving Navigation in Graphical User Interface

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1. Introduction

A typical user interface consists of several buttons, menus, windows, trees and other type of controls. The increased number of GUI elements and complexities of the GUI controls necessitate the user to acquire certain level of skill and efficiency in order to operate the GUI. There are many situations which further make the navigation difficult. For example,

⇒ When there are too many menu boxes and menu items, navigating through the menu is difficult. The situation is worse if the menus have scrollbars.

⇒ When there are too many buttons, icons or other graphical elements on the GUI, it is difficult to select the desired control out of the crowd.
When the user opens multiple windows for multiple documents or applications, it becomes complicated to switch between windows.

When the size of the image or text or other visual element is larger than the size of the screen, it requires scrolling. Too much scrolling makes the navigation complicated.

When the operation requires faster navigation but the pointing device cannot be operated at high speed.

(i) When the objects in the GUI are tiny, or (ii) the GUI operation requires precise cursor movement, or (iii) the pointing device is not suitable for precise operations etc.

When navigation routes are long and complicated, it weighs on the user to memorize the difficult routes.

Thus there are several factors which adversely affect the navigation through a graphical user interface. But a typical computer user may not have training in computer science. Keeping that in view the user interface should be designed in such a way that the user should be able to operate the computer effectively and efficiently without needing for training on computer science.

Ideally the user should face no difficulties in navigating through the user interface. Any operation in the graphical user interface should require minimum pointer operations from the user (Ideal Final Result).

This objective of a graphical user interface has led to several inventions trying to make the navigation simple and efficient.

2. Inventions on improving navigation

2.1 User interface with multiple workspaces for sharing display system objects (US Patent 5072412)

Background problem
The relatively small size of a display screen is one of the major constraints of a graphical user interface as it limits the number of perceptible objects, which can be displayed to the user at any given time. There are some solutions like large virtual workspaces and multiple virtual workspaces to overcome this problem. But in these situations, the user typically needs help in navigation. There is a need for improving navigation in using multiple workspaces.
Solution provided by the invention

Henderson, et al. invented a user interface (US Patent 5072412, Assignee Xerox Corporation, Issued Dec 1991) with multiple workspaces for sharing the display system objects. According to this method the same window will provide different display characteristics to different workspaces. The user can switch between workspaces by using “door” and “back door”.

The objects in the window remain active even after the user leaves the workspace. When the user returns to the workspace it will have the same contents as when it disappeared.

The invention provides an overview display, which shows a representation of each workspace so that the user can navigate to any workspace from the overview.

TRIZ based analysis
The invention provides an overview display for all the workspaces. The user can select any workspace from the overview display and navigate to the workspace easily (Principle-8: Counterweight).

2.2 User interface with simultaneously movable tools and cursor (5798752)

Background problem
Normally a GUI is controlled by a cursor control device (such as mouse), which is operated only in one hand. This sometimes limits the speed of operation. Although the operator has two hands, the other hand remains idle. Using both the hands would have improved the efficiency of navigation.

Solution provided by the invention
Buxton et al. invented a method (Patent 5798752, assigned by Xerox Corporation, Aug 98) which allows the user to operate pointing devices simultaneously with both the hands. While the non-dominant hand (e.g., the left
hand of a right handed user) can do non-precision movements (like selection of tools in a drawing application), the dominant hand can do finer operations needing precise movements (like actual drawing on the worksheet).

In a typical implementation, the input device may include a trackball (at left hand) for positioning the tools and a mouse (at right hand) for positioning the cursor and initiating actions.

**TRIZ based analysis**

The invention advises to operate another pointing device by using the less dominant hand (which is generally idle) in order to improve the efficiency of navigation (**Principle-20: Continuity of useful action**).

As the efficiency of both the hands are different, the invention suggests to use a trackball (for positioning the tools) with the less dominant hand and a mouse (for positioning cursor and initiating actions) with the more dominant hand (**Principle-4: Asymmetry**).

2.3 Method and system in a graphical user interface for facilitating cursor object movement for physically challenged computer users (Patent No 6031531)

**Background problem**

Most features of the graphical user interfaces are designed keeping the skills and requirements of the common people in mind. But the physically challenged computer users often face difficulties in precisely moving the cursor on specific icons on the screen. It is desirable to include features that would allow users to access such graphical objects with greater easiness.
Solution provided by the invention


According to the invention each icon will have an icon domain, which is larger than the icon itself. When the cursor enters into an icon domain, the cursor is automatically positioned at the center of that icon.

According to this method, the icons are graphically magnetized such that the cursor object is immediately snapped towards a desired icon when entering a graphically magnetized surrounding of the icon.

This method assists physically challenged users in manipulating graphically displayed icons and other objects displayed within graphical user interface.

TRIZ based analysis

Ideally the cursor itself should automatically move onto the desired icon (Ideal Final Result).

When the physically challenged user fails to put the cursor exactly on the icon the GUI should be able to understand the intention of the user (Desired result).

The icon’s click area can be enlarged so that the cursor can enter into the click area with less effort (Principle-37: Expansion). Interpreting differently, the icon can be sensitive to accept a selection when the user just moves the cursor close to the icon (Principle-16: Partial or excessive action).

According to the invention, the icons are graphically magnetized to pull the cursors entering into the icon domain. This assists the user by eliminating the need for positioning the cursor object precisely on the icon to select that object (Principle-10: Prior Action, Principle-8: Counterweight).
2.4 Navigation tool for graphical user interface (US Patent 6037937)

**Background problem**
Although scrollbars facilitate scrolling large images and documents, they occupy valuable screen space. They are not suitable for portable devices having small size display. Beside they restrict the navigational movement only to the horizontal or vertical direction. There is a need for a better navigation tool which will use less screen space and can navigate to any direction within a document.

**Solution provided by the invention**
Patent 6037937 (invented by Beaton, et al., assigned by Nortel Network Corporation, issued in March 2000) disclosed an improved navigation tool that may be used to navigate through documents at any direction at varying speeds. The navigation tool is transparent so it does not take up additional screen space nor obscures the text of the underlying document.

The invention is especially useful in portable devices with small displays.

**TRIZ based analysis**
The direction of the navigation not restricted to only the conventional horizontal and vertical movements. It can navigate to any direction (*Principle-17: Another dimension*).

The navigation tool is transparent. Hence it does not obscure the display area (*Principle-32: Color change*).

The user can also control the speed of navigation by accelerating while moving his finger from the center of the circle towards to circumference of the circle (*Principle-15: Dynamize*).
2.5 Expand to wells function in graphical user interface system (6054988)

Background problem
In a graphical user interface the objects are presented in rectangular windows. These objects may be of any kind (container objects, data objects or device objects). The user has to open a window to view the objects.

There are two mechanisms to open a window. One by double clicking on an object, which opens a window called a “well” or a “window within a window” containing all the related objects. Other, by dropping a display control function on the object shown, which also opens a well to display the object. However, both the methods have their own drawbacks. The double click method requires user precision and the display control method is confusing as a separate display control function is needed for each possible well.

Solution provided by the invention
Patent 6054988 (invented by Alimpich et al., assigned by IBM, issued in Apr 2000) disclosed an easy mechanism for displaying objects in a “well” or window within a window.

According to the invention there will be a new display control function called “Expand to Wells”. When the user drops the “Expand to Wells” function on any object, all the wells for that object are opened.

TRIZ based analysis
The invention provides an “Expand to wells” function which applies to all kinds of objects. There is no need for separate functions for different types of wells (Principle-6: Universality).
2.6 System and method for improved navigation between open windows in an application program using window tabs (US Patent 6489975)

Background problem
In a multitasking environment the user operates multiple different programs each using a separate GUI. Typically the operating system displays a separate icon for each application in the task bar. The user clicks on the specific icons on the task bar to switch to the corresponding application. But there is no easy mechanism to open another program (or switch to another program) from an opened GUI.

Solution provided by the invention
Patent 6489975 (invented by Rajesh Patil, assigned by IBM, issued Dec 2002) a new method for navigating between multiple open windows from within the same graphical user interface.

According to the invention, the GUI will present buttons for various different programs. The user may click on the buttons to select which of the windows to display. When a window will be opened a “kill” button will also be associated to the corresponding button to close that window. Thus the user can open or close applications from the same window without moving the pointer to the taskbar or to the desktop as in case of the conventional method.

Besides the GUI may also have navigation buttons such as backward, forward, stop, refresh, search, home etc. to facilitate navigation. The GUI may further have a bookmark bar to comprise bookmark buttons. A bookmark button may link to a specific program, a file, a page, a view within a file, an action or any other linkable portion of a computer system.
TRIZ based analysis

The invention allows opening and closing other applications and files from within the same window (Principle-7: Nested doll).

The invention allows creating and using bookmarks for different programs, views, or pages etc. which can open the program or page or view directly in a single click without going through a number of steps as in case of the conventional method (Principle-21: Skipping).

3. Some more solutions

Navigation is a critical feature of a graphical user interface. Difficult navigation may lead to user frustration and user dissatisfaction. A careful analysis can figure out specific problems in navigation and solutions to those problems. Some more solutions to tackle navigation problems are as follows:

⇛ Displaying a route map to assist navigation (Principle-8: Counterweight). For example, providing site maps in websites.

⇛ Displaying a group of images in a page (in reduced size) can help navigating through the images within the page (US Patent 6097431).

⇛ Using voice commands and gesture commands to control navigation may compensate the limitations of pointer operations.

⇛ Navigating through stacked windows or stacked images by controlling their thickness property (US Patent 6246406).

⇛ Displaying real time navigation information, e.g., displaying cursor location (XY coordinates) on the status bar of an image-drawing program.

4. Summary

The article has analyzed some inventions from US Patent database which have tried to solve the problems of navigating through a GUI. The summary of the solutions can be presented as below:

⇛ Using an “overview display” of different workspaces. The user can see a reduced view of all the workspaces in the overview display and choose the desired workspace from that window.

⇛ Using two cursor control devices simultaneously by both the hands to increase the efficiency of cursor movement in a GUI.
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⇛ Enlarging the click area of the icons so that the cursor can enter into the click area with less effort.

⇛ Magnetizing the icons to pull the cursors while entering into the icon domain.

⇛ Allowing scrolling to all directions instead of restricting it only to the conventional horizontal and vertical movements.

⇛ Using transparent navigation tools, which do not obscure the display area.

⇛ Providing a special function like “expand to wells” that can open different types of objects.

⇛ Proving window selection buttons and window navigation buttons in the toolbar to facilitate opening, switching and navigating through windows.

⇛ Providing bookmark bar and bookmark buttons to open programs, files, pages, views etc. directly without navigating through a number of steps.

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