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Main Principles in GUI design for Data Systems

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Abstract: User interface is a general connection tool for getting the request of user and give back the responses. A special type of user interface is GUI (Graphical User Interface), which is very important in computer world, and you can't find any application without it. Designing a suitable GUI is definitely an important part of designing any application. Due to this, there are some principles that help to create an appropriate GUI. In this paper, we are going to talk about the necessity of a suitable GUI for an information system. So, the goals of GUI will be investigated. Then we will get into common characteristics of a proper GUI.

Keywords: User interface, Graphical User Interface, GUI, information system, information display.

I. INTRODUCTION

When the computers came to existence world faced to impressive developments in various fields of science and industry. Consequently, the societies faced with giant revolution in technology. These changes had many effects on the people lives. These advances went to where that computers and information technology got a definite place in everyday life. One of the important outcomes of these advances is information system. Information system is an integrated set of components for collecting, storing, processing, and communicating information. Business firms, other organizations, and individuals in contemporary society rely on information systems to manage their operations, compete in the marketplace, supply services, and augment personal lives [1]. Designing of User Interface is an important part of designing an information system, and it involves the design of computers, applications, mobile communication devices and websites with the focus on the user's integration and experience [2] [3]. It includes a wide range of projects from computer systems to cars and commercial planes. All of these projects require some skills and knowledge for the end-user [4] [5]. One of the most challenging matters in this field is the need for principles for designing an appropriate Graphical User Interface (GUI) for information systems and databases full of information. In this paper, we are going to represent some guidelines for designing a user friendly GUI according to technical and psychological bases.

II. AIMS OF UI DESIGN FOR A SPECIAL INFORMATION SYSTEM

In this section, we will cover some basics which show the goals and consequently the way for designing a user interface. First, we will talk about types of a user interface and then get into some principles that clarify the general purpose and policies of user interface design.

2-1 Types of user interface

Generally, there are two types of user interfaces which are listed and investigated below [6]:

- Standard User Interface (SUI): In this type, view and user friendliness of user interface is less important and the performance is the main measure. UIs from this type are suitable for applications which are designed for experts.
- Graphical User Interface (GUI): This type is used for the general purpose heterogeneous audience applications. It is based on graphical features and computer vision.

As the first step of UI design, you have to decide which one to use. SUI is out of the contents of this paper, because we are going to investigate the features of a user friendly UI and it goes to GUI design.

2-2 User community cognition

Recognizing the users is an important step in GUI design, so that Hansen [7] nominates it as the first essence of user engineering.
To design an influential GUI, first the detailed information about user community should be taken, such as gender, age, education, taste, type of needed information, width and depth of information, etc [8] [9]. Different people have different tastes. Analyzing information about users in order to find some alike taste points causes to achieve guidelines for designing GUI. It is enough clear that main goal of GUI is to have a better interaction with user [10] [11]. So, recognition of what user wants helps to close this goal.

2-3 Information System tasks recognition

After user community cognition, the tasks of information system should be specified. An information system must be known in order to determine the needs, outcomes and facilities that it can provide [12].
Another important point is basic information providing. According to the content information, there should be ways for uninformed users to improve their knowledge about the content. It means that basic information of the content information should be available through GUI for users that have less knowledge; or at least nominate some resources including books, papers, guidelines, etc for them. It has to be tried to help users to spend less time to find information about content. A GUI designer is most known about the essential information which a common user may need, so he/she should consider it during the design.

III. COMMON CHARACTERISTICS FOR AN APPROPRIATE GUI DESIGN

Nowadays information systems with huge databases are increasing all over the world and each one has an individual GUI. They have their own audiences and applications. But one matter is the same among all of them. That is trying to have better interaction with users to close the user to information which he need. The quality of this interaction is specified by the GUI. A good work that can be considered through GUI design is asking users about their needs. It is often neglected that applications provide a questionnaire to collect the users' ideas. But it can help to make a more user friendly GUI. So, always try to have a feedback facility to get your audience ideas. It helps to discover weak and powerful parts of your work [13].
Furthermore, there are some guidelines that can help to design a proper GUI for applications, which are listed below:

3-1 Information display page

The page that shows the result of queries is probably the most important part of GUI. Shires and Olszak [14] who are pioneers of this field state the following tips for designing a good information display page:

- An ideal page should follow the suitable vision rules such as: balance, regularity, sequence, etc.
- Using space between the sections and paragraphs.
- Putting the different parts of GUI in recommended places. For example, it is better to place the search box in top of page and show the queries in middle.
- Observing punctuation and using suitable fonts.
- Using sequence of pages in place of cramming information in a long volute page.
- Integrating information by putting all information about a special subject in one page.
- Indicating information directly.
- Categorizing the information.
- Labeling the pages and all the items in it.

3-2 Visual components of GUI

Basic visual elements are: dots, lines, shapes, color, texture, and surface which are seen in all views. Regarding the impressive role of visual elements which includes main part of human reception [15], it is recommended that all the subjects that are used to guide user be through images, animations, diagrams and other visual elements. Non-textual materials can help users to comprehend easier, faster and more efficient. Also, it avoids users from boring and eyes fatigue. Less text should be used for help section, because it is time consuming and boring.
Graphical balance of the page is very important. Background, color, font, style, etc should be selected carefully, so that it be readable, easy to understand and attractive [16].

3-3 Colors

Color scheming is one of the most important pars of GUI design. Different colors can impress emotions in different ways. So, they should be consciously used through design [17]. Shneiderman states that more than 7 colors should not be used in a page [18], but Galitz is for with 4 colors [19].
Another point about color scheme is that users who are suffering from vision problems should not be forgotten. Studies ([20], [21], [22], [23], and [24]) have found that the majority of computer workers experience some eye or vision symptoms [25]. To help these users, colors with high contrast can be used. Observing color conflict, contrast in

darkness, contrast in hot or cold colors, supplement conflict, simultaneous conflict, quantity and quality conflict are other solutions [26].

3-4 Symbols

Using the symbols makes the screen more attractive, and users like to see familiar symbols in the page. It helps them to percept the concepts through visual symbols, instead of reading the words. But it should be paid attention that placing unfamiliar or expert symbols for novice users might be confusing. So, these symbols shouldn't be used in wide, and they must be supported by a textual guide as tool tip or any thing else. Rogers believe that establishing a meaningful connection between the symbol and the concept in the unfamiliar user's mind causes some problems [27]. In addition, symbols can cross the language fronts and convey the meaning through visual elements. So, Russo and Boor are concerned about the different meaning of symbols in different cultures [28]. Also, using the symbols may lead to appearing symbolic languages. For example, using triangle in players means "Play", so using the double triangle embodies "Double speed play". For integrating the symbols, ISO suggests some guidelines [29].

3-5 Buttons and options

Users intend to achieve information with only few clicks on buttons and options. It should be tried to avoid design messy pages as it is possible. Crowded pages make users confused and unmotivated to continue. It is better to use key options in page and hide other options under a menu or extra options button. Information should be delivered to user as soon as possible.

Captions of buttons and other option links are very important. They can be self-guides to assist the users. Appropriate labels can help user to send what he wants to application and consequently, he can take the best results close to what he want.

There should be some buttons to load some pages which contain a brief form of information page. It helps user not to face with a huge mass of information and be able to distinguish the information he really needs [30].

3-6 Application messages

Messages exported from GUI have an impressive role in acceptance feeling of users. Choosing suitable words is very important. Also, error messages that convict user for the mistakes can be confusing and cause nervousness. These messages should be in guidance form to prevent novice users from anxiety. Shneiderman [18] reminds the following features for GUI messages:

- Containing useful tips for users
- Positive tone
- User oriented
- Appropriate wording
- Using no similar messages for different goals
- Considering multilevel users
- Integrity in literary form, words and abbreviations
- Correcting the error by the software as much as possible

3-7 Help

Help is a part of GUI that provides the opportunity of learning through working with application. Branjnik et al. believe that help should be designed strategically and based on conceptual model to include the knowledge in it [31]. Trenier categorizes the questions that might be asked by the users as follow:

- What is my mistake?
- Is my act true or false?
- Where am I and then what should I do?
- How do I do?
- How can I get information?
- Why information system faced with problem? [32]

Placing help section in the application pages, is necessary, with the condition that information be comprehensive and sufficient and be able to answer to these questions in a clear way.

3-8 Fast response

Slow response from application leads to dissatisfaction of users. GUI designers should pay much attention to this point that users intend to achieve information in the least time. Even though the novice users have much stamina, but common and professional users can't undergo to lose time.

In some cases that limitation of hardware causes slow speed of actions, GUI designer can create some solutions. The least thing that designer can do is determining the time of each action and inform it through showing appropriate messages.

Response time is defines as expectation of user about necessary time for completing an action, which is based on previous experiences of user. Generally, Shneiderman states that following factors effect the user's expectation:

1. Previous experiments
2. Personality differences of users
3. Functional differences [18]

3-9 Interaction of user and information system

The best GUIs are so designed that are able to response different request of their users. It is recommended that GUI make users to interact with database directly. So, in database applications the tool of this interaction should be provided.

One of the best tools which can be used is search box. User can specify what he wants exactly by this tool. Search box should have varied options to give opportunity for searching through all kinds of resources. Also, messages that are exported from search box should be clear and fluent. Generally, every tool that makes the interaction more powerful must be used in GUI design. Remember that users will be motivated only if they feel the interaction [33].

3-10 Target Platforms

Designed GUI is going to run on a target platform. Target platform might be some kinds of portable devices such as mobile cell phones, PDAs, laptops, etc. It is very important to observe some limitations of there devices such as screen size, keypad limitations, etc. Another important point is observing the energy-efficiency factors to avoid using so much battery energy [34].

3-11 Beautiful environments

Human is a beautiful friendly creature and beauty has an undeniable role in his life. Nowadays, computer graphical tools help to create beautiful images. Using this beauty through GUI design helps to the user motivation to return to the application for more other times. Paying attention to following tips is very effective to design a pretty GUI:

- Coherent page layout
- Using suitable colors and fonts
- Embedding related animations (but don't use them so much)
- Using related images and symbols and place them in recommended places
- Margin scheming
- Paying attention to psychological principles [35]

IV. CONCLUSION

In this paper, first the aims of a user interface were talked. Then some considerations were investigated to clarify the way of GUI. They were "Types of UI", "User community cognition" and "Information system tasks recognition". Specifying these subjects helps to achieve general purpose of GUI function for the special applications.

After finding the function of GUI, it was turn to design. There have investigated some common features that can improve the user friendliness of a GUI. They were: Information display page characteristics, visual components of GUI, effect of colors, symbols characteristics, buttons and options, messages, help of software, effect of fast responding, importance of interaction between user and information system, target platform considerations and beauty.

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