

## SURVEY ON VARIOUS UI DESIGN APPROACHES

<sup>1</sup>SATHYA S, <sup>2</sup>SIVARANJANI A, <sup>3</sup>SANTHI B

<sup>1</sup>M.Tech II Year, Department of Computer Science and Engineering, SASTRA UNIVERSITY, THANJAVUR

<sup>2</sup>M.Tech II Year, Department of Computer Science and Engineering, SASTRA UNIVERSITY, THANJAVUR

<sup>2</sup>Prof, Department of Information and Communication Technology, SASTRA UNIVERSITY, THANJAVUR

E-mail: <sup>1</sup>[sathyas630@yahoo.co.in](mailto:sathyas630@yahoo.co.in), <sup>2</sup>[siv.ranjani@gmail.com](mailto:siv.ranjani@gmail.com), <sup>3</sup>[santhi@cse.sastra.edu](mailto:santhi@cse.sastra.edu)

### ABSTRACT

User Interface (UI) is the prime factor that decides the usability of any products. Nowadays the developer must direct their effort towards the development of UI that function effortlessly. The research in UI design has gained a high attraction due to importance of interactive application and to enhance the user experience. Tremendous approaches are there to design effective UI. Each design approaches have their own special design aspects. In this paper an attempt has been made to review the research studies on various design approaches in the field of UI Design.

**Keywords:** *User Interface (UI), User Experience, UI Design, Design Approaches*

### 1. INTRODUCTION

The term “Interface” denotes a point at which the various system or diverse group interact. UI abbreviated as a communication medium between user and computer [1]. User interface is also termed as Human computer interaction in computer technology. Interface is a combination of hardware and software that receives input from, and communicates output to a user in order to support their performance of a task. Now a days the way people think, work, play have been changed a lot. Likewise there is a tremendous change in people desires also. People always need to gain different User Experience in various fields. In such cases UI is not an exception. Day by day there is some increasing level of shifting in the boundary between human and the computer. As the impact of these needs results in different ways of User Interface Design.

Every designer wish to build high-quality interfaces that are admired by the colleagues, celebrated by users and imitated by competitors [2]. The various tradeoffs between the design protocols and goals are some of the challenges encountered by the designers. The quality of the product and its commercial value in the market are the two important parameters are judged by the good user interface. While designing the user interface

designer should consider the various diverse of users from Novice users to Expert users. A good user interface should let users to understand what has to be done without wasting time by thinking or to have a deep learning about it. According to Albert Einstein “Make it simple, but no simpler [3]. There are various design approaches for designing simple, effective and efficient User Interface.

### 1.2. GOOD USER INTERFACE DESIGN

User interface should be designed in such a way that matches the skills, experience and expectations of its users. Users often judge a system by its interface rather than its functionality. A poorly designed interface can cause a user to make a catastrophic error, because of that some of the software application usage are reduced.

### 1.3. HUMAN FACTORS IN INTERFACE DESIGN

While designing the user interface the designer’s has to consider the human factors. They are

- Limited short term memory
- People make mistakes
- People are different

- People have different interaction preferences

UI designers introduce so many design approaches that may be applied to designers to develop user friendly, efficient and intuitive user experience for humans. This paper summarizes some of the five approaches such as

1. Rule based approach
2. Inverted Pyramid approach
3. Structured User Interface Design Methodology
4. Pattern- Supported Approach
5. Data- Driven approach

One or more of these approaches may be applied to single user interface design.

The rest of the paper is organized as follows. The functional aspects of the various approaches are discussed in section II. Finally in section III contains the conclusions

## 2. VARIOUS APPROACHES

### 2.1 Rule Based Approach

It is also termed as “Language Engineering System for Graphical user Interface”. It retrieves the essential information from the instruction provided by the user and it can construct the user interface according to the user needs. The problem comes into picture during the processing of natural languages such as misunderstanding of verb’s conjugation, inflexion, lexicon amplitude, misinterpretation. Rule based approach tackle these problem by analyzing ambiguity in terms of lexical, semantic, syntactic, and pragmatic [4].

1. *Lexical Ambiguity* - same words give different meaning
2. *Semantic Ambiguity* - Improper understanding of logical situations.
3. *Syntactic Ambiguity* – Incorrect meaning.
4. *Pragmatic Ambiguity* - Statement is not specific and does not have needed information to clarify it.

After receiving request from user the system can automatically check above mentioned criteria to get a correct idea about the user needs. The processing may involve the following steps [4].

- Text Input Acquisition
- Text Understanding
- Knowledge Extraction
- User Interface Design
- User Interface Code

For Example: “Draw a line of width 1.0f, starting co-ordinates (10, 10), Ending co-ordinates (100,100), and foreground color is blue.”

```
private void Form1_Click(object sender, EventArgs e)
{
    Graphics surface = this.CreateGraphics();
    Pen pen1 = new Pen(Color.Blue, 1.0f);
    surface.DrawLine(pen1, 10, 10, 100, 100);
}
```

Figure 1. Example of a Rule based Approach.

The UI designed system understands the given user instruction and extracted the relevant keywords as

*Object=pen*  
*Pen. Color=blue*  
*Pen. Size=1.0f*  
*Object=Line*  
*Line. Starting point=10, 10*  
*Line. Ending point=100,100*

The system can generate a graphical output based on the requirements given by the user.

#### Benefits

This approach gives a solution to the problem of how to generate required UI dynamically. It analyzes the story-line of requirements given by the user in plain English language and sketches the estimated design of required UI according to user instruction.

#### Limitations

Rule based approach is still not very much intelligent to draw UI in better way. Still it needs some improvements in algorithm for generating the more fascinating and acceptable design of UI.

### 2.2 Inverted Pyramid Approach

According to journalists the preferred way of writing is “Inverted Pyramid Approach”. It states: “Start the article by telling the reader the climax”. [5]

This approach tells the UI designers how to deliver the information that is searched by the user. It helps the users to know about the most important information first. By knowing the conclusion first users can easily make the decision either to continue the rest or to skip the remaining part.

**“Delay in delivering relevant information = failure”**



Figure 2. Example for Inverted Pyramid approach [9]

Here in Fig.2 user needs information about “News”. In this Web Encyclopedia it first shows the definition of News then it shows the related content. So user can easily gain the knowledge of the particular at the first time and they can decide either to continue or to skip.

#### Benefits:

This approach having some special features such as providing most needed information at the beginning based on the user interest. It reduces the stress and time associated with the application. It plays a vital role in journalism.

### 2.3 Structured UI Design Methodology:

While designing the UI applications there are some chances that designers might give less importance to certain design aspects. This results in dissatisfaction in the final product. It would be overcome by a new Methodology called Structured UI design Methodology. It is also termed as “Layer-based approach [6].

For showcasing the realistic environment, have to define specific identification of the realistic system through 10 layers of definition for the application going to develop [6]. According to Leonel Morales the 10 layers are [6]

1. Representations of reality elements
2. Organization of represented elements
3. Access method to let the user reach the represented elements

4. Capture method for getting elements existing “outside” the system into a representation “in” the system
5. Actualization method for making the “outside” elements to be corresponding to the “inside” elements.
6. Creation methods for letting the user get new elements “mind created” into the system.
7. Destruction method so the user can “destroy” elements no longer desired in the system.
8. A collection of methods to let the user interact with the elements of the systems, meaning, to let the user “act” over the objects represented in the system.
9. A method to let the user know what the response of represented objects has been to the action performed.
10. Change Notification method to inform the user when object has been changed due to action of other elements in the system or outside it.
11. In case of any problem while designing, designers can go back only to that particular layer for modification. This helps the designers to modify or redesign in a simpler way.

In case of any problem while designing, designers can go back only to that particular layer for modification. This helps the designers to modify or redesign in a simpler way.

#### Benefits:

The designers prefer this methodology at a point when a design process needs “redesign” or “remodeling”. At that time designers select the needed layers from different application which is considered as good enough. Comparison of different interfaces also possible because of its structured nature.

#### Limitations:

It doesn't give any instructions to the designer about how to initialize objects, how to provide a method for creating or removing elements, explanation about how to specify each layer. It only shows that to achieve the needed solution all the layers have to be specified in an order.

## 2.4 Pattern-Supported approach

There are plenty of design guidelines, principles and measures for designing User Interface. By following those designers will get better solution but it is challenging task for them to satisfy all these above. Designers are taking lot of efforts to implement those guidelines, principles and measures in the applications. These efforts are reduced by an Inventory of solutions called Pattern [7].

Patterns are simplified source of information, the context, perfect solutions, etc...It will be very easy for the designers to tackle the problem and let users to act according to the current situation. A System Usability relies on the user of the product, the task, the context of the use. The Inventory solutions or Patterns are designed based on these three terms which are mentioned above. This approach supports various kinds of patterns [7] and they are

1. Business Domain Patterns
2. Business Process Patterns
3. Task Patterns
4. Structure and Navigation design Patterns
5. GUI design Patterns

Each Pattern is interlinked with the previous patterns for supporting the design process.

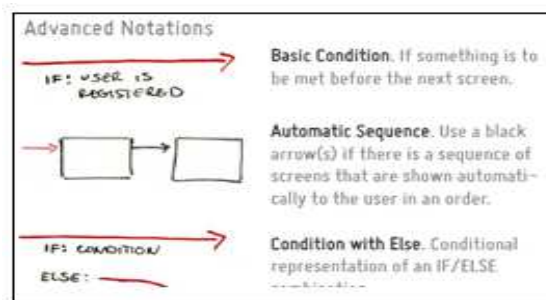


Figure 3. Example for pattern supported approach [10].

Fig.3 shows a simple pattern (storyboard). It describes about the logical condition involved in the project. Using this designer's may get a better knowledge about it.

Benefits:

In software development, a pattern can be considered as a well established design that has an ability to solve a common problem. The patterns provide advantage in development process by improving code standard, scalable design, and readability and minimize the development time. It also improves usability of applications.

## Limitations:

If designers prefer this approach making the decision to use patterns in general can be complex process, but now a days it get reduced by use of systematic design methodology.

## 2.5 Data - Driven Approach

It is nothing but an extraction or collection of needed data from the user's feedback.

Marissa Mayer director of consumer Web Products at Google [8] was involved in UI design at Google and she is insisted to provide data and not her opinions. The method she handled is analysis of user's feedback. For example she was in confusion whether to allow the Google News based on the location or by date. Finally they launched simply as it was. Then they received more number of emails for arranging it by date and only few emails for location based. So designers should allow the users to express their suggestions. User's feedback is one of essential ingredients and it is very useful for the designers for immediate updates in the products.

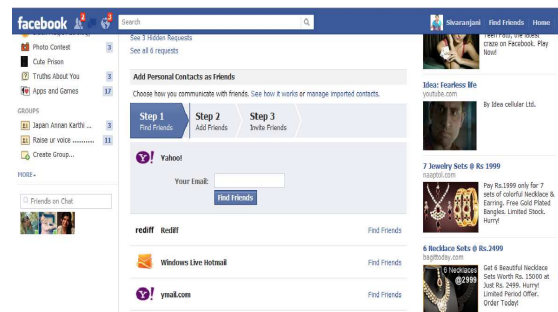


Figure 4. Example of Data Driven approach [11].

Fig.4 shows face book application. By analyzing the various users logs and their needs so many gaming applications and interesting tasks are added up in the Social networks like face book and orkut. This example shows that a new task for finding friends is updated in the sense users can find their friends simply by using respective mail id.

## Benefits:

It mainly focuses on the data quality. It consider features such as users feedback, analyzing the user experience problem while using that application the data can be updated. It satisfies the user needs with high degree.



TABLE 1. TABULAR REPRESENTATION OF VARIOUS APPROACHES

Various Approach	Role	Problem has to overcome	Solution for the problem	Advantages	Reference
Rule Based	Retrieving the relevant information	Difficulties in analyzing the user's instruction	Analyzing the ambiguity in terms of lexical, semantic, pragmatic, systematic	Quick and reliable way for generating graphical user interface	Ref [4]
Inverted Pyramid	Providing climax first	Difficulties in learn unnecessary stories	Providing conclusion first, important information next and other stories last	Users can skip the unwanted things at any time and save their time	Ref [5]
Structures UI	UI design would be in layer conformed structure	Difficult to consider all the design aspects	Application specific element should be define based on 10 layers	Easy to redesign or reengineering	Ref [6]
Pattern Supported	Providing generic solution to the common problem	Hard to apply all guidelines, rules and measures	Providing simplified information, context, perfect solutions	Facilitates reuse of software	Ref [8]
Data- Driven	Deriving the data from the user's feedback	Lack of knowledge in analyzing user's needs	Analyzing the user's feedback and extracting the necessary data	Improving the product quality	Ref [9]

3. CONCLUSION

We attempted to convey a short picture of the research in UI design approaches as it has been emerged from Human Computer Interaction. This paper summarizes some new lessons and research directions to the UI designers.

For Graphical User Interface Design (LESGUID): A Rule based Approach”, Proceedings of 2nd IEEE International Conference on Information and communication Technologies, ICTTA'06 April 24-28 2006, Damascus, Syria.

REFERENCES:

[1] [http://www.webopedia.com/TERM/U/user\\_interface.html](http://www.webopedia.com/TERM/U/user_interface.html)

[2] Shneiderman, Plaisant, Cohen, Jacobs, “Designing the User interface: Strategies for effective Human Computer Interaction”, Pearson Publication - 2011.

[3] Theo Mandel, Ph.D. “Chapter 5: The Golden Rules of User Interface Design”: The Elements of User Interface Design © John Wiley & Sons, 1997.

[4] Imran Sarwar Bajwa, Muhammad Abbas Chaudhary, “A Language Engineering System

[5] Prof.Anirudha Joshi, Gaurav Mathur, “The inverted Pyramid Approach in User Interface Design for Interactive Information Retrieval.

[6] Leonel Morales, “Structured User Interface Design Methodology”, CHI 2001 31 MARCH - 5 APRIL.

[7] Asa Granlund, Daniel Lafreniere, David A. Carr, “ A Pattern – Supported Approach to the User Interface Design Process”, International conference on Human - Computer interaction August 5-10, 2001, New Orleans, USA.

[8] [http://rashmisinha.com/2005/01/13/google-pragmatic-data-driven-approach-to-user-interface design/.](http://rashmisinha.com/2005/01/13/google-pragmatic-data-driven-approach-to-user-interface-design/)

[9] [En.wikipedia.org/wiki/News.](http://en.wikipedia.org/wiki/News)

[10] <http://www.google.com/imgres?q=storyboard+for+UI+design&hl=en&safe=active&biw=1024&bih=679&tbn=isch&tbnid=TeNQ4ytxBycwV>

- [M:&imgrefurl=http://www.smashingmagazine.com/2010/02/05/50-free-ui-and-web-design-wireframing-kits-resources-and-source-files/&docid=QBV8ixnHhtGiiM&imgurl=http://media.smashingmagazine.com/wp-content/uploads/2010/02/linowski.jpg&w=500&h=300&ei=4I9T9\\_GI6rrAfaq7TjBw&zoom=1](http://www.smashingmagazine.com/2010/02/05/50-free-ui-and-web-design-wireframing-kits-resources-and-source-files/&docid=QBV8ixnHhtGiiM&imgurl=http://media.smashingmagazine.com/wp-content/uploads/2010/02/linowski.jpg&w=500&h=300&ei=4I9T9_GI6rrAfaq7TjBw&zoom=1).
- [11] <http://www.google.com/imgres?q=facebook&hl=en&safe=active&sa=X&biw=1024&bih=679&tbm=isch&prmd=imvnsu&tbnid=Ewofn4gyvqdPAM:&imgrefurl=http://mashable.com/2011/02/04/facebook-7th-birthday/&docid=2julHqQtdcavzM&imgurl=http://5.mshcdn.com/wp-content/gallery/fb-history/facebook-2007-640.jpg&w=640&h=583&ei=6-89T9SPMInNrQeHufTaBw&zoom=1>.
- [12] <http://www.iso.com/Research-and-Analyses/ISO-Review/ERM-The-Need-for-a-Data-Driven-Approach.html>

[13].Clayton Lewis, John Rieman,"A task centered user interface design".

[14].Harold Thimble by, Ann Blandford, Paul Cairns,"User Interface design as a system design".