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Incorporation of Human Personality Types (Based on MBTI) in Web User Interface Designs Using Genetic Algorithm

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ABSTRACT

Nowadays, users are increasingly accessing internet applications for learning, business or pleasure using a variety of computing devices which include head held devices, mobile phones, televisions and internet appliances. Web interface design for pervasive computing is becoming an area of significant importance within the research area of human-computer interaction and visual interface. There is unimaginable number of web sites and each of them has different designs and interfaces to interact with their users and viewers, who come from many different countries, cultures and personalities (Feuerlicht, 2008). Web user interface (WUI) designers have to consider to design user interface based on users' demands and wishes and when we face with many different users from different parts of world with a variety of personalities, it is very important to build and design interfaces that caters them. Therefore, it is important to create and design a web interface which satisfies most users based on human personality types and interface design factors.

Keywords: Human computer interaction, Personality types, Genetic algorithm, Web designing.

1. Introduction

Most users interact with computers by typing, pointing, and clicking. The majority of work in human-computer interfaces in recent decades has been aimed at creating graphical user interfaces (GUIs) that give users direct control and predictability. These properties provide user a clear model of what commands and actions are possible and what their effects will be; they allow users to have a sense of accomplishment and responsibility about their interactions with computer applications.

There is a close relationship between a learner's personality and his/ her learning style. A user's personality determines the ways a learner controls his/ her emotions and feelings during the learning process. There have been too few studies to draw a definitive conclusion on the relationship between personality type, user interfaces, and learning. There has been evidence that there may be a significant correlation determined that the Sensing/Intuitive dimension was significantly related to instruction in a multimedia environment.

The authors investigate effects of human personality types on web designing elements with visual designing factors and types of human personalities. Data gathered from respondents are analyzed with Genetic Algorithm method.

2. Human Personality Types – Myers Briggs Type Indicator

Personality type refers to the psychological classification of different types of individuals. Personality types are sometimes distinguished from personality traits, with the latter embodying a smaller grouping of behavioral tendencies. Types are sometimes said to involve qualitative differences between people, whereas traits might be construed as quantitative differences (Bernstein, 2008).

The Myers-Briggs Type Indicator (MBTI), developed by Isabel Briggs Myers and her mother, Katharine Cook Briggs, is a well-known and widely used personality inventory based on the psychological theories of Carl Gustav Jung. It is often used as a tool for discovering and understanding different normal human personalities and can be utilized in a variety of applications such as academic counseling, career development, conflict resolution, leadership training and relationship counseling, just to cite a few.

However, it should be noted that MBTI is not a test as there are no right or wrong answers and it does not reveal everything about oneself (Fundation, 2010).

The goal of knowing about personality type is to understand and appreciate differences between people. As all types are equal, there is no best type. The MBTI instrument sorts for preferences and does not measure trait, ability, or character. The MBTI tool is different from many other psychological instruments and also different from other personality tests (Fundation, 2010).

• **Extraversion or Introversion:** Indicates whether people prefer to acquire their personal energy from the outer world of people and activities, or from inner world of ideas and thoughts. E.g., extraverts prefer being in large group of people and introverts tend to take pleasure in quieter activities.

• **Sensing or Intuition:** Describes how people take in information, whether they focus on what is actual and real (factual-based) or prefer to interpret or apply meaning to what they see. E.g., people who prefer sensing is down-to-earth and more dependent on past experiences, whereas people who prefer intuition are considered idealists and rely more on the future.

• **Thinking or Feeling:** Indicates how people prefer to make decisions, whether it is based on logical thinking or influenced by their concerns for themselves and others. E.g., people who prefer feeling over thinking are generally predominant in helpful professions such as counselors and they pay close attention to other people's needs. In addition, those who prefer thinking may seek factual clarity in solving disputes.

• **Judging or Perceiving:** Describes the way you manage your life and how you deal with the outer world, whether in an orderly manner or spontaneously. E.g., people who prefer judging like to have everything in order and in a scheduled manner. On the contrary, people who prefer perceiving are more unplanned and spontaneous in their lifestyle, including making decisions (Faheem Ahmed, 2010), (Patrick L. Wadlington, 2008)

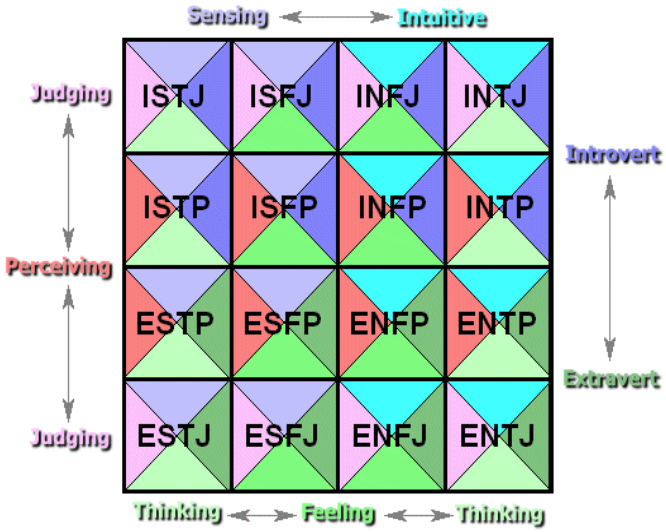

Figure-1. Personality Types

3. Designing Web Elements – Components

Better understanding of web designing components lead us to the idea of what are the visual designing factors which are related to human personality types and may be changed based on different user personalities.

There are several items which affect visual web designs. The aesthetic requirements of visual design are becoming the important factor of Web pages success. The positioning and application of three essentials of vision design rules such as visual focus, visual processes and visual space, in web page interface design provide useful reference for designers (Ma, 2010). So based on visual design principles, the most effective part of visualization in designing are shown as main factors of graphical designing components as below:

3.1. Color

Color is an indispensable visual element in the Web, now the Web designers dedicate to the research of visual beauty, the results are mainly focused on the aesthetic relationship among the color, style and emotion, whereas the researches on the color interaction, especially the researches on dynamic interactive color, have not been paid extensive and systematic attention. In terms of the current application of Web-

based dynamic interactive color, the principles of semantic communication for dynamic color in the interaction are put forward. The page-navigation bar is taken as an example to illustrate the optimized design and verify usability according to the dynamic interactive color (Zhou, 2008).

3.2. Texture

Texture can refer to the actual surface of a design or to the visual appearance of a design. In the first case, the audience can actually feel the texture, making it unique from the other elements of design. Selection of paper and materials in package design can affect actual texture. In the second case, texture is implied through the style of design. Rich, layered graphics can create visual texture that mirrors actual texture.

3.3. Font

Type, of course, is all around us. In graphic design, the goal is to not to just place some text on a page, but rather to understand and use it effectively for communication. Choice of fonts (typefaces), size, alignment, color, and spacing all come into play. Type can be taken further by using it to create shapes and images.

3.4. Lines

Lines are used to divide space, direct the eye, and create forms. At the most basic level, straight lines are found in layouts to separate content, such as in magazine, newspaper, and website designs. This can of course go much further, with curved, dotted, and zigzag lines used as the defining elements on a page and as the basis for illustrations and graphics. Often, lines will be implied, meaning other elements of design will follow the path of line, such as type on a curve (Poppy Evans, 2008).

3.5. Shapes

From ancient pictographs to modern logos, shapes are at the root of design. They are used to establish layouts, create patterns, and build countless elements on the page. With graphics software such as Illustrator, creating and manipulating shapes is easier than ever, giving designers the freedom to create them at will.

3.6. Art, Illustration & Photography

A powerful image can make or break a design. Photographs, illustrations and artwork are used to tell stories, support ideas, and grab the audience's attention, so the selection is important. Graphic designers can create this work on their own, commission an artist or photographer, or purchase it at all price levels on many websites (Poppy Evans, 2008).

4. Genetic Algorithm

A genetic algorithm (Isabel Briggs Myers) is a procedure used to find approximate solutions to search problems through application of the principles of evolutionary biology. Genetic algorithms use biologically inspired techniques such as genetic inheritance, natural selection, mutation, and sexual reproduction (recombination, or crossover). Along with genetic programming (GP), they are one of the main classes of genetic and evolutionary computation (GEC) methodologies (William, 2008).

Before the authors start with genetic algorithm as problem solving in computer criteria, a brief definition of genetic algorithm in biology is given.

Every organism has a set of rules, describing how that organism is built; all living organisms consist of cells. In each cell there is same set of chromosomes which are string of DNA and serve as a model for the whole organism. Each chromosome consists of genes, block of DNA and each gene encodes a particular protein that represents a trait (feature), e.g., color of hair. Complete set of genetic material (all chromosomes) is called a genome therefore particular set of genes in a genome is called genotype. The physical expression of the genotype (the organism itself after birth) is called the phenotype, its physical and mental characteristics, such as eye color, intelligence etc.

Cross Over: when two organisms mate that share their genes; the resultant offspring may end up having half the genes from one parent and half from the other. The process is called recombination or cross over.

Mutation: the new created offspring can then be mutated. Mutation means that the elements of DNA are a bit changed. These changes are mainly caused by errors in copying genes from parents.

Fitness: the fitness of an organism is measured by success of the organism in its life and survival in the environment (K. F. Man, 2001).

Based on the mechanics of biological evolution, in 1962 John Holland, at university of Michigan developed the Genetic Algorithms technique to understand processes in natural system and design artificial system retaining the robustness and adaption properties of natural system which provides efficient techniques for optimization and machine learning application widely used in business, science and engineering.

Genetic Algorithms (Isabel Briggs Myers) are the main paradigm of evolutionary computing. GAs are inspired by Darwin's theory about evolution – the "survival of the fittest". In nature, competition among individuals for scanty resources results in the fittest individuals demeaning over the weaker ones. GAs are ways of solving problems by mimicking processes nature use; i.e., Selection, Cross over, Mutation and accepting, to evolve a solution to a problem. GAs are adaptive heuristic search based on the evolutionary ideas of natural selection and genetics. GAs are intelligent exploitation of random search used in optimization problems. GAs although randomized, exploit historical information to direct the search into the region of better performance within the search space (Chakraborty, 2010).

5. Weka Application

WEKA is a software for perform Genetic Algorithm for our data in the project. It is a software that helps the author to produce a combination of the data from the population.

WEKA is a collection of machine learning algorithms for data mining tasks. The algorithms can either be applied directly to a dataset or called from your own Java code. WEKA contains tools for data pre-processing, classification, regression, clustering, association rules, and visualization. It is also well-suited for developing new machine learning schemes (Frank, 2006).

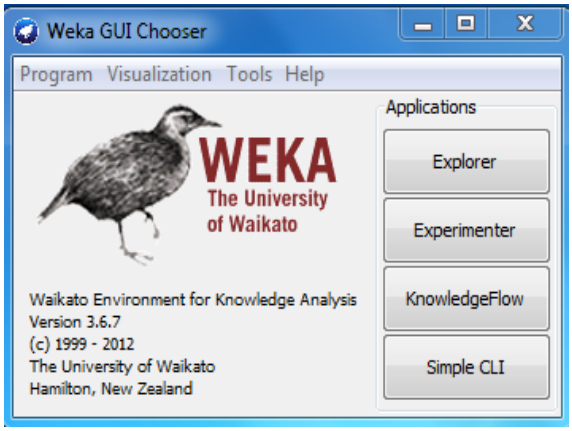

Figure-2. WEKA Application

The WEKA workbench contains a collection of visualization tools and algorithms for data analysis and predictive modeling, gathered together with graphical user interfaces for easy access to this functionality. The original non-Java version of WEKA was a TCL/TK front-end to (mostly third-party) modeling algorithms implemented in other programming languages, plus data preprocessing utilities in C, and a Make file-based system for running machine learning experiments. This original version was primarily designed as a tool for analyzing data from agricultural domains, but the more recent fully Java-based version (WEKA 3.6.1), for which development started in 1997, is now used in many different application areas, in particular for educational purposes and research. Advantages of WEKA include:

- free availability under the GNU General Public License
- portability, since it is fully implemented in the Java programming language and thus runs on almost any modern computing platform
- a comprehensive collection of data preprocessing and modeling techniques
- ease of use due to its graphical user interfaces

WEKA supports several standard data mining tasks, more specifically, data preprocessing, clustering, classification, regression, visualization, and feature selection. All of WEKA's techniques are predicated on the assumption that the data is available as a single flat file or relation, where each data point is described by a fixed number of attributes (normally, numeric or nominal attributes, but some other attribute types are also supported).

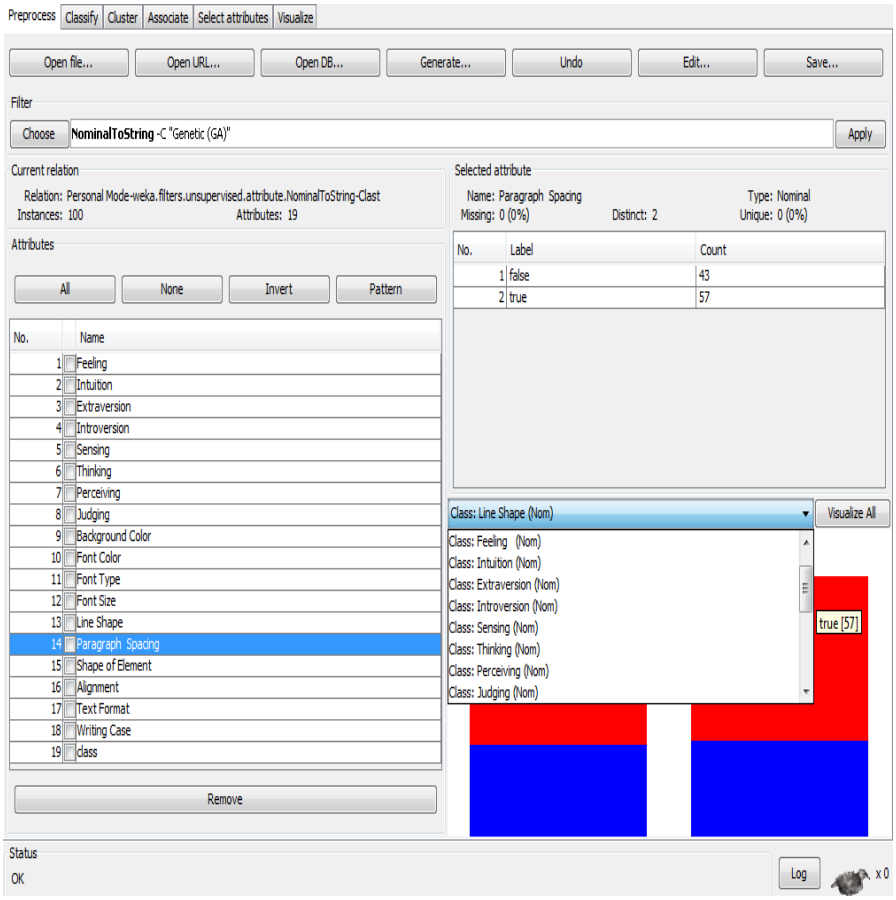

Figure-3. Experiment View

WEKA's main user interface is the Explorer, but essentially the same functionality can be accessed through the component-based Knowledge Flow interface and from the command line. There is also the Experimenter, which allows the systematic comparison of the predictive performance of WEKA's machine learning algorithms on a collection of datasets. WEKA provides access to SQL databases using Java Database Connectivity and can process the result returned by a database query. It is not capable of multi-relational data mining, but there is separate software for converting a collection of linked database tables into a single table that is suitable for processing using WEKA. Another important area that is currently not covered by the algorithms included in the WEKA distribution is sequence modeling (Mark Hall, 2009).

6. Analysis

Two questionnaires have been designed which included indicating personality types of participants and the other one was for finding his/her preference in visual designing factor. Therefore, for getting accurate results, the minimum of the participants should be 150-200 subjects.

6.1. Questionnaire: Personality Types Indicator

Myers Briggs Personality Indicator's test consists of 36 questions that indicate subject's personality types based on sixteen different types (Figure 1). After administering and analyzing the questionnaires, the percentages of unique personalities of subjects were identified.

The second survey consists of eighteen questions related to web designing elements-components which are designed in a sequence of priority, including Color design; Font and text design, shape design and visual design.

6.2. Data Analysis

The data collected is analyzed and measured for each group of personality types with the web designing components.

Then, the Genetic Algorithm is used to find fitness function formula. The pie chart below shows the results of personality types (Figure 4).

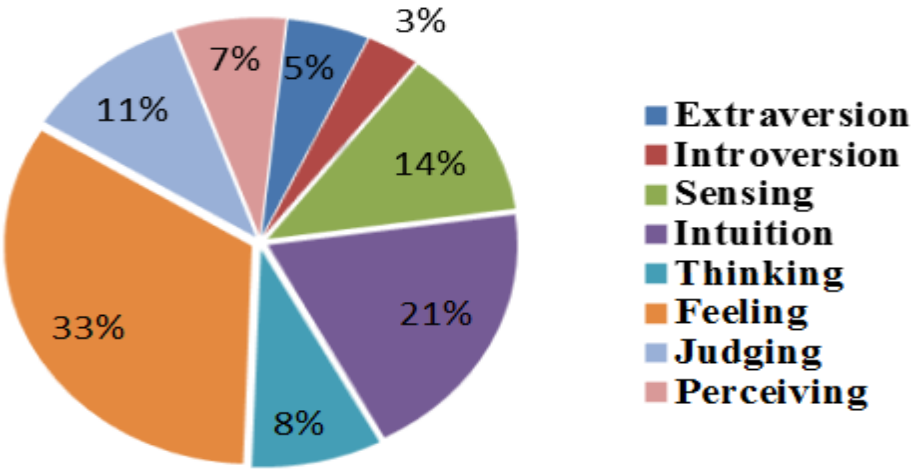

Figure-4. Personality Types

According to the above analysis chart, 33% of the participants are from **Feeling** type and 20% of them are **Intuition** people, and more than 50% of the subjects are into these two groups of eight main personality types.

The next step of data analysis is measurement of popularity of each web designing components for the different personality types – as instances of analyzing measurement, the charts will be shown the main elements of web design (Background Color - Font color- Font type - Line shape) for those eight popular personality types which are measured in above chart. The scope in the project and the survey is to demonstrate the relation between personality types and web design factors.

Background Color: the following chart is shown the favorite background colors for each personality types between four main colors (Blue-Green-Black-White), therefore shows which color is most popular color for different personality types. Based on the result of favorite background color shown in Figure 5 the favorite color for each group is;

Feeling: **Blue** with 40% popularity
Intuition: **Green** with 37% popularity
Extraversion: **White** with 40% popularity
Introversion: **Black** with 39% popularity
Sensing: **Black** with 42% popularity
Thinking: **Blue** with 34% popularity
Perceiving: **Black** with 35% popularity
Judging: **White** with 35% popularity

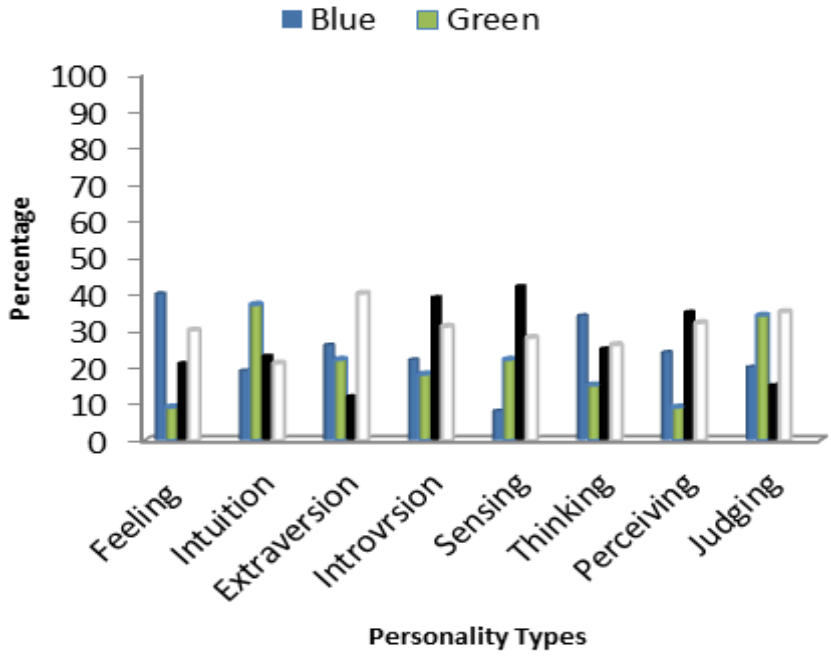

Figure-5. Background Color

Font color: the following chart shows the favorite font colors for each personality types, between four main colors (blue-green-black-white and others). Based on the result of the chart shown in figure 3-3 the favorite color for each group is;

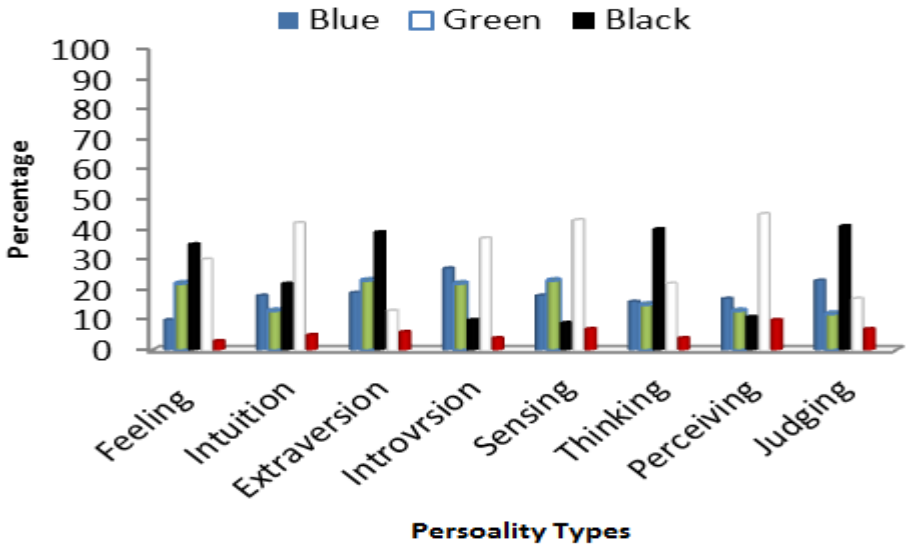

Figure-6. Font Color

So based on the result of the surveys and eight groups of human personality types effect on visual web designing components, and combination with Genetic Algorithm, a webpage is designed

The tables in next page are shown complete result of both survey embedded hence all the most popular web design components for the eight human personality types plus special combination with GA are demonstrated and in additional the ninth mode is added.

Table-1. Personality Design Elements

	Background Color	Font Color	Font Type	Font Size	Line Shape
Feeling	Blue	Black	Times New Roman	12	Mixed
Intuition	Green	White	Arial	10	Straight
Extraversion	White	Black	Calibri	14	Straight
Introversion	Black	White	Times New Roman	12	Curved
Sensing	Black	White	Times New Roman	10	Curved
Thinking	Blue	Black	Arial	16	Angled
Perceiving	Black	White	Calibri	14	Curved
Judging	White	Black	Arial	12	Curved
Special Mode	Blue	White	Times new Roman	12	Mix

7. Design & Implementation

A project methodology is needed to define the process to be used to conduct the project and build the set of deliverables. It will state how this project will be accomplished and specify the interaction with other group.

Design is creating a blueprint for the prototype to be implemented. It describes how the system shall be built and takes place at several levels (Bennett et al., 2006). It provides the skeleton structure of the software and highlights key issues. Two models for the prototype have been discussed in a socio-technical aspect. The most practicable solution has been selected to be designed as the prototype. According to Bennett et al. (2006) the design should be concerned with the overall architecture and the detailing of its classes.

7.1. Synthesis of Ga Functionality

WEKA is used to create a dataset with two main classes as the Personality types class which has eleven attributes and web design components class which consist of eight attributes shown in Table 2 (personality-design dataset) for generation of a Special Mode using Genetic Algorithm Method.

Relation: Personal Mode-weka.filters.unsupervised.attribute.NominalToString-Clast

No.	Feeling Nominal	Intuition Nominal	Extraversion Nominal	Introversion Nominal	Sensing Nominal	Thinking Nominal	Perceiving Nominal	Judging Nominal	Background Color Nominal	Font Color Nominal	Font Type Nominal	Font Size Nominal	Line Shape Nominal	Paragraph Spacing Nominal	Shape of Element Nominal	Alignment Nominal	Text Format Nominal	Writing Case Nominal	class String
1	true	false	true	true	false	false	false	true	true	false	true	true	false	false	true	true	false	true	c0
10	true	false	false	false	false	true	true	false	false	false	true	false	true	false	false	true	false	false	c0
100	false	false	false	false	false	true	true	false	true	true	false	true	true	true	true	false	false	false	c1
11	false	false	false	true	true	true	false	false	true	true	true	false	true	true	false	false	true	false	c0
12	false	true	true	false	true	false	true	false	false	false	false	false	true	true	false	false	false	true	c0
13	true	true	false	false	true	false	true	false	true	true	true	false	true	true	false	true	false	true	c0
14	true	false	false	true	true	false	true	false	true	true	false	false	false	false	true	false	true	true	c1
15	false	true	true	false	true	false	false	true	false	false	false	false	false	true	true	true	false	false	c0
16	false	false	true	true	true	true	false	false	false	false	true	false	true	true	false	false	true	false	c0
17	false	true	false	false	true	false	true	false	true	true	true	true	false	true	true	true	true	true	c1
18	false	false	true	true	true	true	true	false	false	false	true	false	true	true	true	true	true	true	c0
19	true	true	false	true	true	false	true	true	true	true	true	true	true	false	true	false	false	true	c1
2	false	true	true	false	false	false	false	false	true	false	true	true	false	true	true	false	false	false	c0
20	false	true	true	true	false	false	true	true	true	false	false	false	false	false	false	true	false	false	c0
21	true	true	true	false	true	true	false	false	false	true	true	true	false	false	true	false	true	false	c0
22	false	true	false	true	true	true	false	false	false	true	false	false	true	true	false	true	false	false	c0
23	false	true	false	true	true	true	false	false	false	true	false	false	true	false	false	false	false	true	c0
24	false	false	true	true	false	true	false	false	false	true	false	true	true	true	true	true	true	true	c0
25	true	false	false	true	true	false	true	true	true	true	false	true	false	false	true	false	true	false	c1
26	false	true	false	true	true	true	true	true	false	true	true	true	true	false	false	false	true	false	c1
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28	true	true	false	false	false	false	false	true	false	true	false	false	false	false	false	false	true	false	c0
29	false	false	false	false	true	true	true	false	false	true	false	true	false	true	true	false	true	true	c1
3	false	true	true	true	true	true	false	false	false	true	true	false	false	true	true	true	true	true	c0
30	true	true	false	false	true	false	false	true	true	true	false	true	false	true	false	false	true	true	c1
31	true	true	true	false	false	false	false	true	false	true	false	false	true	true	false	true	false	false	c0
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33	false	false	false	true	true	true	false	false	true	false	false	true	true	true	true	false	false	true	c1
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38	false	false	false	true	false	true	false	true	true	true	true	true	true	false	true	false	true	false	c1
39	true	true	false	true	true	false	false	true	true	true	true	true	true	false	true	false	true	false	c1
4	false	true	false	true	true	true	false	true	false	true	false	true	true	true	true	true	false	true	c1
40	false	false	true	false	true	true	false	true	true	false	false	true	false	false	false	true	false	true	c0
41	false	true	false	true	true	false	true	true	false	true	true	false	false	true	true	false	true	true	c0

Table-2. Personality Design Dataset

7.2. Web Design Methodology

According to Lynch et al. (2001), interfaces are built on basic structural themes that govern the navigational interface and mould user's mental models. They are basis of how the information is organized. The three basic structural themes are sequential, hierarchies, and webs.

The hierarchical design for the interface is shown in the figure below. This design is based around the main screen. Once the user successfully opens the application, the main screen shall be displayed. The main screen enables the user to take control and access other screens easily. This will support the bread crumb navigation of the device, as each screen is under has its predecessors trails. So after the input of the

correct username and password, the main page is viewed and user can select the subject and go to related pages and is able to change the Mode to change the webpage design.

7.3. Interface Design

Except the template, keys, menu-bar and other interface components which are designed with HTML, JSP and JQuery, the website consists of nine main CSS Sheets as personality modes. The user can select "Mode" as a drop down menu and he/she may select each of personality modes to see the desired graphical design. Webpage consists of three view sections; upper screen, middle screen and lower screen.

8. System Testing

Testing demonstrates that the system appears to be working according to user's specification and that performance requirement appears to be satisfied. Testing plays an important role in software development. Testing is important for the project as it enables to understand what is expected of the software being designed (Bradley, 2008). It is used to ensure the functionality of the system and to find errors/faults in the system, which can be fixed in due time.

The main importance of testing is to validate the software against its requirements (Bradley, 2008). This enables to identify that the software being developed satisfies the user requirements. The system needs to meet the requirements in order to be 'good' software. There are various methods that can be used for testing. Each method has its own criteria of testing and its own expected result. Testing not only means using the appropriate methods but also ensuring that the area being tested is of ultimate importance. In other words, testing demonstrates that the system appears to be working according to user's specification and that performance requirement appears to be satisfied. The E-Learning website is tested by private institution students.

9. Conclusion

Study on human personality type and its effectiveness on designing components, especially in web application field is a wide area of Human Computer Interaction. Therefore, it is very useful and important, because it can change user' mood during interaction with a web application. Understanding and adapting with user personality types could help to increase number of website customers and therefore increase consumers of its service, in result it will give financial benefit.

This research and its final product as e-learning website covers eight different web graphical designs according to the personality type-mode character and genetic algorithm.

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