Adaptive Interface for Multi-users and Its Evaluation

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Summary

Adaptive User Interfaces or multi-user interface are one of the biggest challenges in human-computer interaction but creating interfaces which are interactive and adapt according to user preferences is very difficult to achieve it. Here in this paper we will be discussing a simple single-page web interface that will appear to be different for different users according to their preferences we are creating interactive web page based on choices of the user which he/she made when the web page first visited. We have evaluated the results based on an experiment in which we had 13 participants. We have also shown graphical representation of our results of survey to have clear understanding of the subject's reaction to the interface.

Keywords:
Adaptive Interface, Human-Computer Interaction, Multiuser interface, User Interface

1. Introduction

With the rise in interactive UI, the adaptive user interface has become prominent for such systems. Even in one of the best applications users usually use a very small part of the functionality that is a large part of user interface goes unused. Another thing to consider is that UI element usage is different for different users. It is a huge challenge for UI designers to create and design a user interface for multiple users and multiple devices. In order to solve this problem one of the most common solutions is adaptive interfaces for interactive systems. An adaptive user interface we create UI in such a way that system UI adapts according to the user preference. So what is usually done is multiple interfaces are created for different functionality based on the user so that whenever such type of user comes it shows the user interface accordingly.

This system can also take benefit from context awareness that is system can adapt based on the context provided. Our goal in this paper is to provide usefully and interface in which elements are placed in such a way that is best suited for that user based on the user's preferences. In this paper a simple single-page prototype is created that shows video comments description and based on user choice it selects the best possible combination of UI elements. We

are also performing the experiment on 15 users and get their feedback in order to see how effective our UI is.

2. Related Work:

In [1], researchers have used combinatorial optimization for the distribution of UI elements. [1] also deals with dynamic changes in the application based on the user it also deals with the problem of cross-device UI but the evaluation of this technique is not good enough, the number of subjects in experiment is very less and evaluation parameter can also be improved. [1] Also provides optimization and a mathematical formula. In [2], researchers had proposed a methodology that is model based, device and domain-independent. The methodology proposed in [2] depends on user experience and the context of user. To evaluate methodology and tools in [2] they have used statistical and user-centric methods.   In [3] authors have discussed an adaptive interface for the people who have problem with pointing and navigation in an application, this system helps people with a physical impairment to navigate and point in any application easily. Researchers in [3] have used 27 subjects for experiment. Work in [3] provides interpretation in order to a better perceive user's preferences and expectations on the design of user interface.   Authors in [4] have personalized UI for particular types of the user at the semantic level and provide a framework for development of which is based on personal profile. They have also extended the framework with ontology-based creation of UI that is automated.

3. Adaptive User Interface:

The User Interface whose size color and position and availability of UI elements changes based on certain criteria for different users and devices are called adaptive user interfaces. It provides high level of personalization in the user interface. As there is variety of appearances for the same application and are to be shown according to the user, which is really a difficult task and a very interesting

research topic. The adaptive user interface can increase the accessibility t of the computers as well.
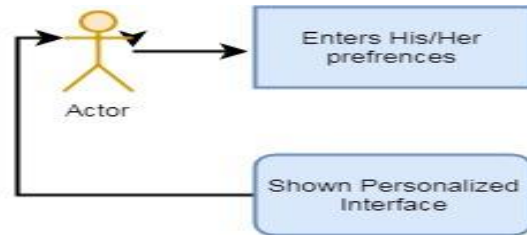
4. Methodology:

Fig. 1 Methodology

Whenever a user request for the web page, he/she is asked for his/her preference based on that preference he/she is shown the interface. We have created a simple web page that consists of 5 questions and from the responses to those question we will create a personalized UI. Fig 1.2 shows the actual UI in Fig 1.3 we will see how and what preference can be set for that user. Fig 1.4 shows the personalized UI as the user doesn't like to read comments he won't be shown comments.
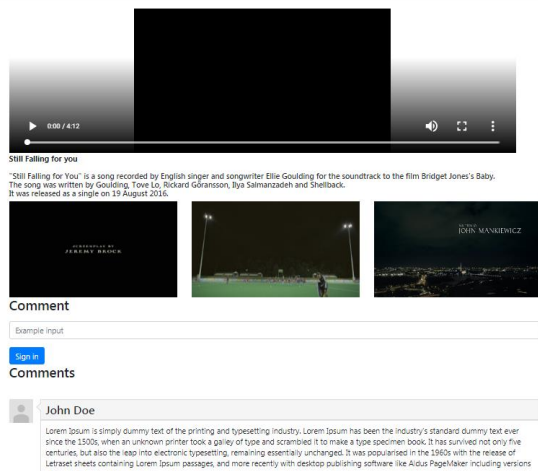

Fig. 2 Complete Original UI
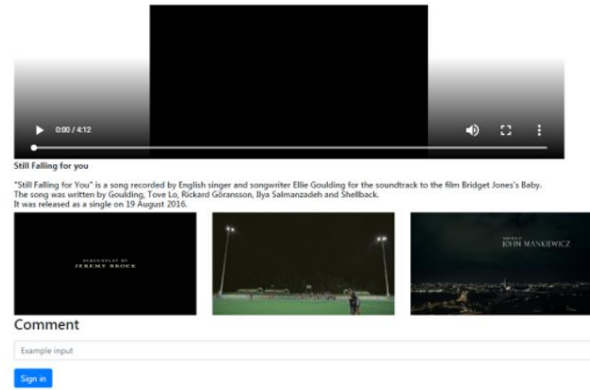

Fig. 3 Personalization choices for UI

Fig. 4 Personalized UI based on choices

5. Implementation:

We have created a web application that asks for user preference on one and page shows personalized version a video playing web application on other pages We implemented all these using HTML, CSS, JavaScript, Node JS. The front end of the application is simply based on HTML CSS and JavaScript and backend is on Node js. All Questions are predefined responses are recorded and based on those responses we use conditions to render a particular UI as intended from the preferences of the user.

Fig. 5 Implementation workflow

6. Experimental Work:

We have conducted an experiment in which we have shown our application to 12 participants 7 females 5 males between the age ranges of 21-27 after they had the first-hand experience of the application they were asked to fill a survey on Survey Monkey Question and results are shown in Table 1.1.

7. T-Test:

T-Test draws sample from both of the sets then assuming a null hypothesis that the two forms the problem statement that means are equal. With the help of certain formulas, various values are calculated which are compared against the standard values, based on that the null hypothesis is either accepted or rejected accordingly. In case null hypothesis is accepted it will indicate that data reading is real and strong and are not by chance.

$$t = \frac{\overline{X_1} - \overline{X_2}}{S_{X_1 X_2} \cdot \sqrt{\frac{2}{n}}}$$

$$S_{X_1 X_2} = \sqrt{\frac{1}{2}\left(S_{X_1}^2 + S_{X_2}^2\right)}$$

$$d.o.f = 2n - 2$$

$\overline{X_1}$ = Mean of data for group 1

$\overline{X_2}$ = Mean of data for group 2

$S_{X_1 X_2}$ = Grand Standard Deviation

S_{X_1} = Standard deviation of data for group 1

S_{X_2} = Standard deviation of data for group 2

$d.o.f$ = degrees of freedom

n = Total number of values

Summary

	Group 1	Group 2
Mean	19.8863	80.1137
Variance	234.4575	234.4575
Stand. Dev.	15.312	15.312
n	8	8
t		-7.8667
degrees of freedom		14

8. Results

Based on the experiment we conducted we see people are interested in adaptive interface and are comfortable using it which can be proved by results of question no 1 and 6 results also show that people want preference and automation together we can't go for only single approach as they still have problem figuring out exactly what they want but people we are very much aware of importance and need of the adaptive interfaces. The T-Test that we performed shows a huge difference in mean between two samples showing these are different and due to small amount of participants we can't say for sure whether mean is stable or not. One of the most important findings of the test is the means of two samples are significantly different which makes complete sense as we have two samples which are opposite of one another.

Table 1: T-test Result of Questioner Survey

| Q NO:	Question	% of Yes	% of No
1	Do you want all applicants to be responsive according to your choice	91.67	8.33
2	Do you want an automatic adaptation of user interface	90.91	9.09
3	Do you want the system to ask your preference of UI adaption	83.33	16.67
4	Do you want a system that does both ask preferences and adapt automatically as well	75	25
5	Did the interface in paper performed exactly according to your preferences	75	25
6	Did it make you feel comfortable	100	0
7	Were you right about your preference for UI	75	25
8	Do you think there should be only a single UI for all users	50	50
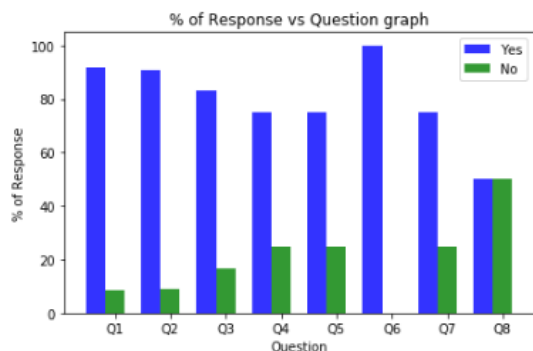
Fig. 6 Percentage of Responses Vs Question

Conclusion:

In this paper, we have discussed what are the adaptive interfaces and need of the interface which vary from person to person and need to have such kind of interfaces. We have concluded from the response of the subject that there is the need for adaptive interface people were comfortable with the interface but we can't go either only manual preference setting or automated we have to find good combination of both. The limitation to our system was it asking preference manually there was no automation there so future work regarding this work could be finding out a hybrid approach that provides adaptive UI based on both manual preference matching and automated UI generation based on previous behavior.

Acknowledgment:

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