MyAds: A Social Adaptive System for Online Advertisment from Hypotheses to Implementation

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Online advertisement is one of the major incomes for many companies; it has a role in the overall business flow and affects the consumer behavior directly. Unfortunately most users tend to block their ads or ignore them. MyAds is a social adaptive hypermedia system for online advertising and its main goal is to explore how to make online ads more acceptable. In order to achieve such a goal, various technologies and techniques are used. This paper presents a theoretical framework as well as the system architecture for MyAds that was designed based on a set of hypotheses and an exploratory study. The system then was implemented and a pilot experiment was conducted to validate it. The main outcomes suggest that the system has provided personalized ads for users. The main implications suggest that the system can be used for further testing and validating.

Keywords Adaptive hypermedia, e-advertisement, social, hypotheses, exploratory study, framework

I. INTRODUCTION

Online businesses are facing the challenge of keeping up with the increasing competition every day. This had enforced businesses to ensure they sustain a competitive advantage over others [1]. One of the main incomes for many online companies is online advertising [2], which make this area a hot topic of research. Online advertising is the process of delivering a marketing message through different media such as banners and e-mails to mention some [3]. Unfortunately most users tend to block or ignore these advertisements [4]. This paper aims at examining the acceptance of online advertisement and proposing a solution for the problem of inappropriate advertisement. The main research question is:

Q0: Can personalized advertising help advertising to be more acceptable?

And the main hypothesis beneath this question is:

H0: *Personalization, based on customization and adaptive hypermedia techniques, as well as social networking data, provide an accepted form of online advertising.*

This paper discusses MyAds, a social adaptive hypermedia system that has been developed to test the previously mentioned hypotheses. This paper presents a set of hypotheses that have been used to design a theoretical framework; an updated framework is then used to propose the updated system architecture, which is the backbone for the system implementation. A pilot experiment was done to test the implemented system and delivered a number of results that can be used for further investigations in this area of research.

II. RELATED WORK

Many online systems offer what is supposed to be a "personalized experience" in order to attract more users to their services. One of the leading companies in this direction is Google. **Google** uses a keyword search where it lets the advertisers to choose the words that will trigger the search for the advertisement and then charges them via click rate. However, the ads need to be displayed and clicked on to be charged by Google. It functions that way to insure that the ad is not only seen but also that the buyer arrives to the website of the advertiser. Therefore, basically, if the advertisement is directed from Google to the advertisers' website, the advertisement company will pay Google [5]. Google also works as the publisher of advertisements (brokerage system). It delivers targeted advertisement to the website of the publisher with two options: AdSence for content and AdSence for search. Google periodically analyses the content of the publisher site and provides content based on that. Which leads the publishers to add the Google search box on their pages – Google pays back – sponsored links. AdWords, a complementary Google program, uses targeted words. It is keywords focused. Online advertisement frameworks have been around for some time now, but most of them are as part of e-commerce frameworks. One of these frameworks is the ubiquitous advertising on WWW framework [6], which has been used for a long time, as it deals with the very first involvement of online advertising. The framework works as an agent between the users and the advertisers to overcome the problem of "advertising vacuum", in the shape of a brokerage system, to address the users ignoring the ads. The framework takes the advertiser's content and places it within the users' browser, taking in consideration the users' tastes [6].

Another framework is the interactive advertising and presences framework. This framework focuses on

interactive advertising. It suggests changing the general definition of advertisement and moving it from the generic and massive approach to more of a personalized, quiet and engaging one [7].

Other commercial examples are **Yahoo Search Marketing (YSM)** and **Microsoft AdCentre** which are using the same technique of keywords matching. The disadvantages of their approach are [8]:

1. Limited number of keywords that can be used
2. Ineffective for reaching a large volume of users
3. Mismatch between the advertisement and the keyword used

Facebook offers a new model for advertisement, with a viewing percentage of 1 out of 5, which is 20%, and this is relatively high in comparison to the huge number of advertisements ignored every day, and that is one of the reasons to consider using social networks as an advertising tool. There are many ways for business promotion, such as: users can post links, videos, pictures, fan pages, groups and even advertisements. Also businesses can create their own pages where users can *like* and *share* [9]. Facebook does its targeting through looking at users' profiles and collecting all the demographics, sexual preferences, location and interests and then displays it on their pages – this are recommendations Facebook uses for targeted segments. Still these are all recommender systems, and not adaptive systems. Facebook is a recommender system with social interaction [10].

On a research level, AdRosa is an advertising tool that works through remote open site agents. AdRosa is a system that deals with automatic personalization of web banners, the personalization of the advertisements is not automatic as the system uses web content and web usage mining depending on the knowledge extracted from web page content, previous historical sessions and the current behaviour of users [11]. Unlike the current research, AdRosa uses lightweight user models, based only on the interaction with the system, and no further user data. Moreover, AdRosa doesn't use the rich source coming from social networks, which the current research implements.

Adaptive hypermedia (AH) provides personalized services by modelling users' goals and preferences [24]. It has been widely used for providing adaptive and personalized services in the e-learning area (e.g., [25, 26]), and recently the e-advertisement area (e.g., [15]). By introducing AH, an e-advertisement system can maintain users' profiles, in order to deliver ads more precisely by taking consideration the users' background and preferences.

As explained before, most of these systems have touches of personalization one way or another. Nevertheless, none of them have used any adaptation, such as adaptation of presentation or adaptive navigation support. Also none of them, expect Facebook, have used information retrieved from social networks, as they relied heavily on the information directly entered by the user or information based on previous purchasing history.

III. System Desgin and Implementation

The process of designing a system that answers the main research question contained several phases.

The first phase is to define the main hypotheses for the system use; these hypotheses represent the basis of the theoretical framework. The second phase was an exploratory study that aimed at involving actual users in the process of system design. A set of requirements were derived from the exploratory study, as well as studying the gaps in the literature. These requirements were used to design the system architecture and implement the first iteration of MyAds.

A. Main Hypotheses

The main hypotheses address the different viewpoints of the research. They are designed to cover stakeholders, technologies and appropriateness of online advertising to mention some. The hypotheses are:

- H1: Adaptive hypermedia is appropriate for online advertising in terms of being non-intrusive, smoothly integrated, aligned with user expectations, and attractive.
- H2: A new theoretical framework is needed for adaptive advertising, as prior frameworks are not appropriate.
- H3: Adaptive advertising is best generated using a standalone system that proposes the adaptive ads. Social networks themselves can work as a platform for advertising and may be considered appropriate.
- H4: Stakeholders are buyers, readers, users, companies, brokers, to mention some, and all of these stakeholders need appropriate representation in a generic framework, based on their respective involvement (different level of involvement is expected, and priorities for an implementation need to be integrated in the framework, i.e., differentiating between core stakeholders and additional ones).
- H5: The Evaluation of the appropriateness of adaptive advertising is via creating a flexible framework that allows building of flexible systems supporting the various features determined by the previous hypotheses.

B. Exploratory Study

An Exploratory study was conducted using a user centred methodology [12]. This methodology is part of a participatory design that suggests including actual users in the process of system design and requirement gathering

[13, 19, 20]. The experiment was conducted with the help of students from the Politehnica University of Bucharest and the main outcomes suggested a set of system requirements as follows [14]:

1. It should be based on (*input*):
   - User modelling techniques.
   - Browsing and purchasing history.
2. It should provide (*output*):
   - Live notifications about the advertisement in terms of what has been clicked on or viewed by other users.
   - Targeted advertisements using social networks.
   - Extended advertisements to cover mobile applications.
   - Social capability to interact, chat, comments about the advertisement.

These initial requirements helped in defining the fundamentals of the system and the way the system should be built. In addition, we aimed to address the main gaps found in literature in terms of lack of research-based adaptive advertising models.

C. *Theortical Framework and System Architercture*

The theoretical framework maps the hypotheses presented before with the suggested set of requirements that have been explored this framework and layered architecture (inspired by the Dexter model [21] and Topolor [22]) are an updated version of a theoretical framework and system architecture that have been represented in [15]. The reason of updating both the framework and the architecture is because they weren't addressing all the hypotheses and didn't have a clear distinguish between the different stakeholders and aspects within its representation in the hypotheses. Fig. 1 represents the theoretical framework for the MyAds system.

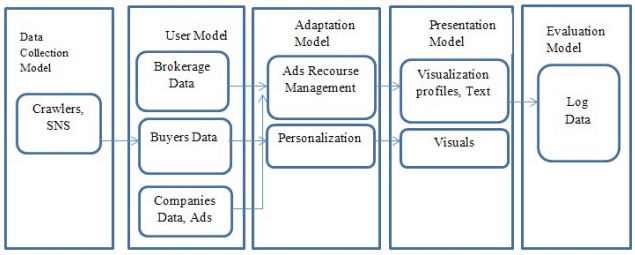

Figure 1.MyAds Proposed Theoretical Framework

The framework is divided into five main layers. The main reason for separating the layers is to insure flexibility within each layer and at the same time maintain the homogenous interaction between the layers [16].

The first layer is the *Data Collection Layer;* this layer is the gateway for all the data. Data sources vary; there are data related to advertisements, users, social interactions and data collected from social networks. The second layer is the *User Model Layer*; in this layer, all the distinct user profiles are established and differentiated. Each user will have their own distinct representation in order to use these data for further adaptation and personalization. Also in this layer the different stakeholders are represented. The main ones are the buyers and the brokers from whom the data is collected via the data collection layer. In the *Adaptation Layer* the appropriate advertisement is mapped onto the user, based on the previously defined user model. The personalization is obtained and specified in this layer. All the intelligence happens in this layer in term of applying the adaptive hypermedia algorithms and align it with data mining techniques. The *Presentation Layer* is the layer that provides direct interaction and contact with user. The profile visualization as well as the text and advertisement representation is decided in this layer. The final layer is the *Evaluation Layer*, which collects the interactions on the system and saves them as log data, to further evaluate and study, and to be inform further modifications of the user model.

The theoretical framework works as the base for the system architecture and it is used to modify the main system components.

The system architecture is the outcome of the design phase, where the main system components are defined. Fig. 2 shows the system architecture.

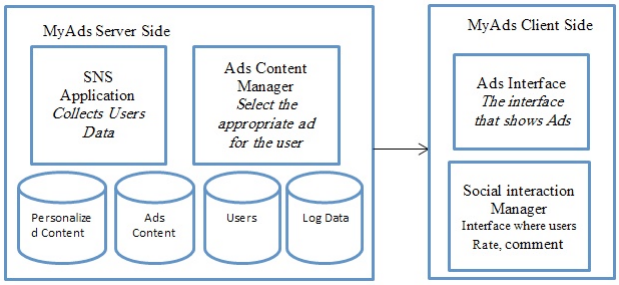

Figure 2.MyAds System Architecture

The system architecture describes the main component of the system. It divides the system into the server side and then client side, as this is a web- based system.

On the server side, all the main system operations are conducted. The main components are:

The SNS Application: this component controls all the operations related to the social network application. Some of these operations are importing users' data and work as a single sign-in line, where users can access the system via logging into their SNS account.

The Ads Content Manager: this component controls the mapping between the user models and the advertisements. In this component the adaptation take place.

Data Base Set: the data base set includes databases for the advertisements, users, log data and the personalized content. All the operations that happen in the system are saved and located in the databases.

Ads Interface: this component is located on the client side. It is the component that controls the display of the advertisement; the advertisements are directed from the ad content manager in the server side to the interface controller.

Social Interaction Manager: this controller is concerned with all the social interaction that occurs in the system.

These represent interactions like commenting/ writing reviews, rating - where users can both rate the system performance as well as give their opinion on whether the system provided personalized advertisements for them or not.

D. System Implementation

The first iteration of the system development has taken place, by implementing a web-based application called MyAds. The system was implemented using Java and MySQL, and for the interfaces design, Dreamweaver was used. The system aimed to produce personalized advertisement to the user registered in the system by matching their interests with the advertisement. A Facebook API was integrated into the system, so that users have an alternative login via their Facebook account using the single sign in property, as the system registration process may be more time consuming. Fig. 3 shows the home page for MyAds, where the users login into the system. The MyAds logo is representing people with different nationalities and backgrounds, holding the name of the system, to indicate that there is something for everyone and everyone can get the customized experience that they are looking for.

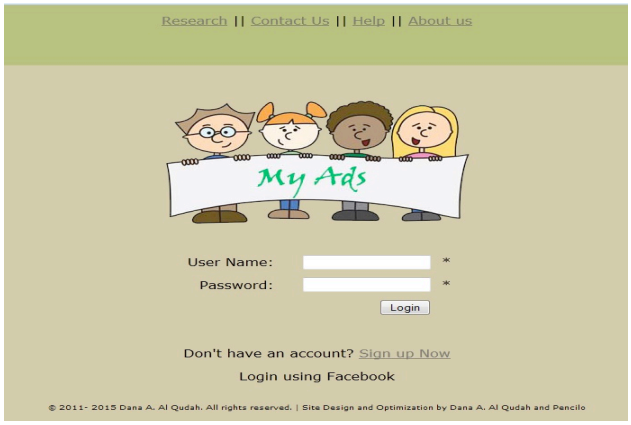

Figure 3.Home Page for MyAds

Fig.4 is an example of a customized advertisement page. From the advertisement, we can see that the user is a female who is interested in fashion, so the system displayed fashion related items. The system also allows for feedback, rating and commenting, thus introducing an element of evaluation within the regular system use. Users can have different interactions within the system, like the social interaction.

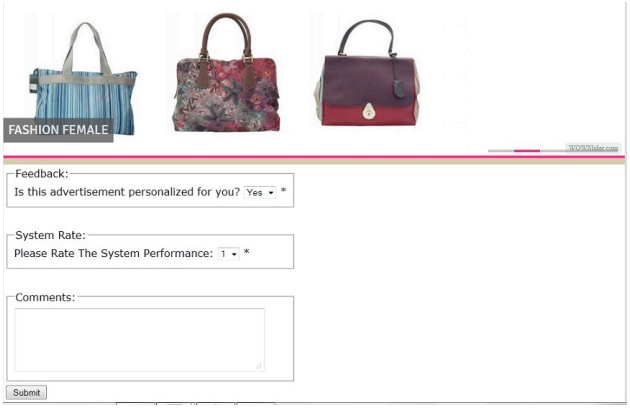

Figure 4.A Personalized Advertisement for a Female who is interested in Fashion

IV. EXPERIMENT

After the system implementation was conducted, a pilot experiment took place. The main goal of the experiment was to test the implemented system in relation to the related hypotheses.

A. Experiment Participants

The experiment was conducted in the University of Jordan, with the help of 4th year Business Information Technology students. . The experiment was held with two different classes with 23, 24 students in each slot adding up to a total of 47 participants. The experiment was conducted over two hours. The first hour 23 students tested the system then the second hour another 24 students used the system. The students were already separated in different groups – as the module is taught one hour for each group. Because this is a business oriented application, so there is no need to do any controlled experiment and it applies to any internet user. The experiment started by introducing the system and the background research, then the students started logging in via system registration and different advertisement were shown to them based on the information they had entered earlier in the registration process. After the advertisements were displayed, they interacted with the system by giving feedback, rating and commenting on it. This will be covered in the results section. Before the end of each session, the students were given questionnaires to evaluate the system in a more formal way.

B. Hypotheses Relation with Questionnaires

After the system has been used it is crucial that it is evaluated, in order to test the hypotheses and to examine the next steps in terms of system development and enhancement.

The questionnaire contained 8 questions and used the Likert scale [17] for evaluation. The answers range from strongly disagree to strongly agree. The reason for using this scale for evaluation is because it helps in capturing the variation of answers and the distances between answers [18].

Table 1 illustrates the relation between each question and the related hypotheses. Please note that some questions examine only a specific aspect of the hypothesis.
Not all the hypotheses have been addressed in the questionnaire because not all the hypotheses have been covered in the system implementation. Follow- up research is being conducted at the moment to address all the hypotheses and cover all the aspects related to them.

Table 1: Questions, Answer range, and their related Hypotheses

Questions and Answer range / / Related Hypothesis	
Q1: The advertisement slider made the advertisement more acceptable? (Strongly agree, agree, neither, disagree, Strongly Disagree)	
Q2: The feature of "rating the system/slider" made the system more personal? (Strongly agree, agree, neither, disagree, Strongly Disagree)	H5 , H1 , H3
Q3: The feature of selecting that "the advertisement was personalized for you" made the system friendlier? (Strongly agree, agree, neither, disagree, Strongly Disagree)	H5
Q4: The feature of "reviewing the system/slider" made the system more personal? (Strongly agree, agree, neither, disagree, Strongly Disagree)	H5 , H1 , H3
Q5: The advertisement slider suggested advertisements that were personalized according to my interests? (Strongly agree, agree, neither, disagree, Strongly Disagree)	H5

The questions were designed to be simple and direct. The whole experiment was conducted in English, as the students are normally taught in English. Nevertheless, when the questionnaire was designed, it aimedd to be as straightforward and simple as possible, because English is not the first language for these students.

C. Results

The results of this experiment were obtained from two sources. The first source was the answers to the questionnaire, and the second source was the information available on the log files saved in the database.
The features implemented in the database, such as the feedback, rating and commenting aimed to collect other source of information to be used for the evaluation and to incorporate the social aspect within the system.
As a research-based system, it is not possible to trace if the user is actually going to buy the proposed product or not, so we adopted another way to evaluate the user's opinion of a product, namely directly asking if the product was personalized for them. The question was "Is this product personalized for you?" (Please refer to Figure 3).

1) *Results from Questionnaires*

One of the main resources for evaluating the system was the users' answers to the questionnaires that they were asked to fill in when they finished using the system. The main outcomes were as follows; when the users were asked if the advertisement slider suggested personalized advertisements 56.52% of the users agreed (see Fig. 5). This suggests that the shown ads has matched the interest of the user which agrees with hypothesis five that suggests that the current framework succeded in delivering personlized advertsiment. In this propertion the 95% confidence interval with no continuity correction suggests a lower limit of 0.4225 and an upper limit of 0.6979. The proportion of 0.5652 falls almost in the middle of the intervals. The results also prove to statistically significant because when compared against the null hypothesis which suggests that people won't care the results achieved 0.00 significance and the result is less than 0.05 leaving the results to be statically significant. Please refer to fig 6 for the results of question one from the SPSS.

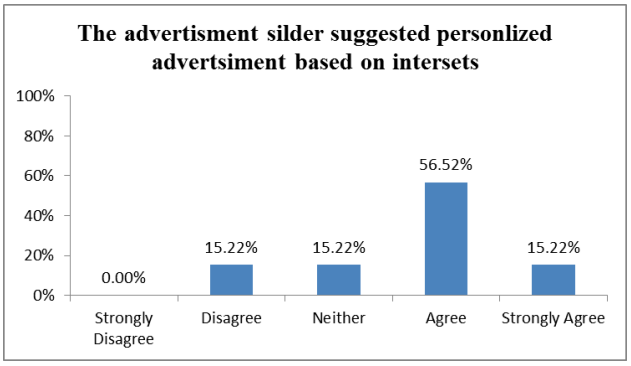

Figure 5.Acceptance for the proposed Ads

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Question_3	47	4.0851	.80298	.11713

One-Sample Test

	Test Value = 3					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference Lower	Upper
Question_3	9.264	46	.000	1.08511	.8493	1.3209

Figure 6. Statistical Significance of Previous Question

Another outcome from the questionnaire was when the users stated their opinion on social interaction within the system; specifically, in rating the system, The hypothesis suggested that people should agree or strongly agree to this, 47% of the users agreed that by rating the system they could interact with the system and that this provided some personalization for them and 19% strongly agreed on the hypothesis. The total percentage of people agreeing – within different levels – on the rating feature 66% of them have agreed. The null hypothesis suggests that 40% or more don't care that the rating feature will make the advertisements more personal refer to figure 7. When conducting a t-test for the sample and compare it against the null hypothesis the value of the significance was 0.00 making the results highly significant since it is less than 0.05

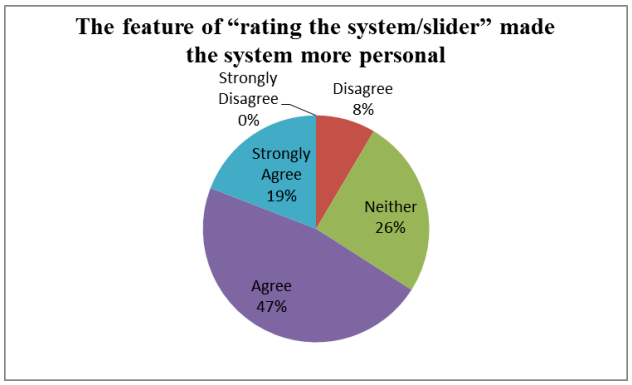

Figure 7.Users' response for the rating feature in MyAds

2) Results from log-files

The log files contained information about the users' interaction with the system. When the users were asked if the advertisements shown to them were personalized for them, they all stated yes. All the students agreed that the system has provided personalized advertisements with 100% percentage. This gives a sense that the system frameworks with the simple aspects that it tried to cover were successful in attracting the users to the system and make this forum of advertising acceptable.

When they were asked to rate the system on a scale of 1-5, with one is being the lowest and five being the highest, their responses are as shown in fig8. The reason there was a rating option in the system is to address hypothesis number 3, which suggested social interaction can play a role on the system acceptance as a dedicated system compared to a light weighted one.

The figure shows that 22 users out of 47 rated the system 1 out of 5. In the feedback they have given, the reason for the low rating is the actual display of the advertisements and that the system didn't look nice and attractive enough for them, so the system graphics should be re-considered. 12 users rated the system 5 out of 5 and their feedback was mentioning that the idea is new and can be helpful for online shoppers.

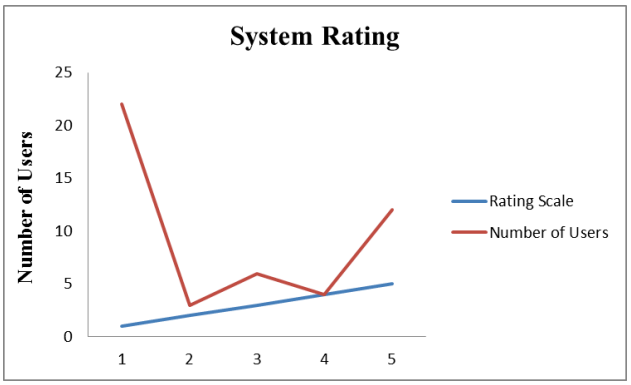

Figure 8: Users rating for MyAds

V. DISCUSSIONS AND CONCLUSIONS

This paper suggested a new approach to try to solve the problem of online advertisements being neglected by users. As many companies invest heavily in this domain and it is considered one of the major activities conducted online, this is an important research area. The approach was derived from a set of hypotheses and an exploratory study conducted in our previous research. The results of the exploratory study suggested a number of requirements that were taken into consideration the process of system design and implementation. The main outcomes from the exploratory study recommended the use of social networks data as a source of data, rather than rely on the information provided by the users only. Further more, it suggested including the users in the experience of proposing the advertisements, by allowing them to interact with it. The theoretical framework was later suggested were the different stakeholders that are to use the system were addressed, based on their level of interaction in the system. The theoretical framework was divided into five main layers to ensure the flexibility of the functionality described by each layer. The system architecture is divided into the client side and the server side. On the server side, all the heavy-duty work is happening, where the server generates the adaptive advertisements after mapping the user model with the related advertisements. The first iteration of the system is implemented to test the suggested hypotheses using Java and MySQL. The experiment was conducted in the University of Jordan with the help of 47 senior students. The main outcomes of the experiment were that most of the students have admitted that the proposed system make the advertisements more acceptable for them which addresses the main research question that stated that personalized advertising help advertising to be more acceptable. They have also agreed that the social interaction with the system made the experience more personal for them and this addresses the third hypothesis that indicate the user of social interaction in the system and was covered in the questionnaire in question two and

four (refer to table 1). One of the main problems identified was the system design, as the students complained that the system design did not cater to their taste. This is the first iteration of the system and the main issues to be addressed in the second iteration include issues such as the use of appropriate user modelling techniques, the appropriate adaptive hypermedia techniques and addressing usability issues highlighted by the users. We also intend to explore the users' parching behaviours, in order to improve the user modelling in the system, using data mining and visualization tools [23].

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