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Abstract

Interdisciplinary research into novel application areas such as interactive advertising is benefited greatly by the wide availability of networked mobile devices. The majority of PDA and mobile phones available today support Internet browsing and multimedia content delivery while they permit advanced user feedback, offering rich communication capabilities for advertisers. In addition, new multimedia technologies such as Flash, Shockwave and other game technologies enable the development of new customised and portable advertising applications.

This paper describes the design of an interactive system where advertisements are delivered on-demand, the user responds to the content ensuring message delivery while system design prevents unwanted communication to be circulated. Various relevant issues are discussed, including the underlying data-flow, user-interaction, system security, human factors and the development of content for use in multiple advertising scenarios.

Keywords: Mobile Advertising, Interactive Multimedia, Networked Mobile Devices, User Payback

1   INTRODUCTION

Interactive advertising is clearly an emerging field with high economical potential, as it is aided greatly by technological advances and the wide availability of networked mobile devices. Their advanced multimedia capabilities enable customised and personalised advertisement systems to infiltrate and establish within the advertising market (Petros Kavassalis, 2003). Various reasons are identified as principal factors that lead the market in this direction. Most users carry the mobile devices with them and demonstrate increased familiarity in performing basic tasks such as answering to SMS, MMS messages and using Java applications. Literature research and experience in the field has revealed that similar systems and methodologies have been developed for networked computer-based platforms (Shea, 2008).

In this paper we introduce a novel system design described through a precise mobile advertising methodology, designated to attract the user's attention and enable involvement through interaction, an approach used successfully in various other research fields (Biswas, 2008; Jaimes & Sebe, 2007; Leahu, Schwenk, & Sengers, 2008; Shea, 2008; Trifonova, Jaccheri, & Bergaust, 2008), educational applications (Deliyannis & Simpsiri, 2008; Deliyannis, Vlamos, Floros, & Simpsiri, 2008) and the arts (Biswas, 2008; Popper, 2005; Strapatsakis, 2008; Trifonova, et al., 2008) that require user involvement. The main development stage describes the creation of a client-server application, used to deliver interactive multimedia advertising content on-demand. The users are rewarded for each successfully communicated message, while the provider is guaranteed that the content has been received and viewed by the intended recipient, and it is also possible to view and process these interactive responses. Various types of rewards are supported. These include prizes such as additional talk-time that may be credited directly to the subscriber's mobile account, electronic coupons and other forms of electronic payback. We focus particularly on the talk-time or electronic credit case, as according to the Mobile Video Advertising Research Study by the Mobile Marketing Association completed in late 2006 among mobile subscribers in

the US it was found that "approximately 23% of mobile subscribers are positively predisposed to the idea of watching advertisement supported video on their handsets, more than 43% of mobile video viewers and intenders—or more than 19 million consumers— agree that they would watch advertisements in order to watch mobile TV/video for free and nearly 20% of viewers and intenders—or more than 9 million consumers—agree that they would watch advertisements in order to watch mobile TV/video for a reduced fee" (Force, 2007). Clearly, the user's perspective, simple and direct service-oriented awards are preferred by users, when compared to those that involve complex processes and delayed payback.

2 SYSTEM OVERVIEW

A principal system aim is to deliver advertisements that are viewed by the targeted customers. This can be achieved with the use of networked mobile devices, and the development of an advertising service that rewards the user with talk time credited directly to the account by their mobile provider. The process may be briefly summarised in the following client-server transaction:

Stage 1, Subscription: The user subscribes to the service by sending an SMS message containing name and mobile phone model. The user is subsequently informed that for further customisation of their account they may join the system website in order to enter personal preferences and other related information, and that it is possible to unsubscribe at any time from the service by sending an SMS that contains the word "STOP".

Stage 2, Advertising process: The system commences sending messages, one at a time, according to the phone type capabilities. Correct user-response rewards the user-account with the response-cost and the appropriate additional credit. Incorrect response credits the user account only with the response cost (or cost of the messages sent by the user) in order to balance-out the communication cost, providing no additional profit to the user. In order to minimise the charges originating from a user that may continuously send incorrect feedback, the system is programmed to lock the account after a successive receipt of a number of non-valid responses for an adjustable period of time in order to protect both itself and the user respectively. Furthermore in order to minimise its total operating expenses the system will only supply the users with a specific amount of advertisement according to their response rate. The advertising formats supported range from SMS, to MMS or JAVA-enabled applications and web pages. User-system interaction is implemented through existing communication channels and 2G/3G networks that support GPRS connectivity for application-based advertising content.

2.1 Users and Interaction

When a message is sent to the user-device it contains two information items: the advertisement requesting the user to respond by performing a series of actions, within a given time limit. For example for SMS and MMS messages the users may have to communicate back to the sender via the same channel, responding to a question raised in the advertisement content. With JAVA applications interaction may be more complex, and it can range from capturing and broadcasting video or audio, to playing interactive games. The field of interactive advertising and the development of such content is an evolving and interdisciplinary research area that combines amongst others the fields of content-context transfer, HCI, aesthetics and psychology (Deliyannis, 2007).

Custom Users

*username	*password	**number	**type	f_name	l_name	m/f	age	occupation	city	….	interests

deljohn	r573y3w	697XXXXXX	iphone	Ioannis	Deliyiannis	m	30	Scientist	Corfu	...	Sailing
anna23	1432grh	694XXXXXX	Samsung EN252	Anna	Ksenou	f	22	Student	Athens	...	Music

General User

*number	**type
693XXXXXX	Nokia 3210
699XXXXXX	iphone

Table 1a, b. User database instances with completed relevant fields. The key field is "number" and "type" is necessary for correct message transfer.

Two user-types are supported, namely "general" and "custom", shown in table 1a and 1b. The term "general" describes a user who communicates via the basic method of SMS messages, no profile details are stored within the system and the only known data for this type of user is their phone number, mobile phone model and application date. Data gathered from anonymous users could be used in statistics being held about the type and number of correct or incorrect answers, stored under an anonymous user profiles that record responses for further evaluation. Anonymous users are not guaranteed to preserve their account in case of change or loss of their phone number. Any rewards credited to a specific account will be lost at the shame time the related phone number expires. On the other hand, registered users have the ability to alter their information into the system by logging in through their username/password, should such event occurs.

User-customisation is supported by the "custom" user account, permitting beyond the storage of personal preferences additional information such as the registration of particular interests, selection of language and geographical localisation. This presents the advertisers with an advantage, as it enables the delivery of messages that may apply more to the specific user-profile, in a voluntary basis. Other examples cited in the literature achieve similar results via indirect user-observation and derivation of data, in some cases with the use of "indirect" means including live reporting of the users' position in the cellular network (Mobile, 2009). On the other hand, our proposed "voluntary" registration relies on users to refine further their existing account by entering personal data throughout the web, thus revealing personal preferences and characteristics. Such a user should be able to invite friends to join the service and be rewarded accordingly, say by utilising their existing social network. Table 1a displays four typical user entries with all the required and some optional fields of information, allowing the system to function properly.

2.2 Single Media and Multimedia Advertising Communication

Three types of advertising containers communicated to the user according to the type of mobile device utilised. The first category utilises SMS messages. It is mainly used to send general content and question-answer type requests, returning the underlying cost of the message and any additional reward upon correct user-response. A typical message would include a question with fixed and numbered possible responses one of which is correct. The user would have to respond by sending a text message containing the correct

number. A numerical response is considered safer as it aids in the reduction of typing errors, which the system or a human operator would then have to process further upon user complaints.
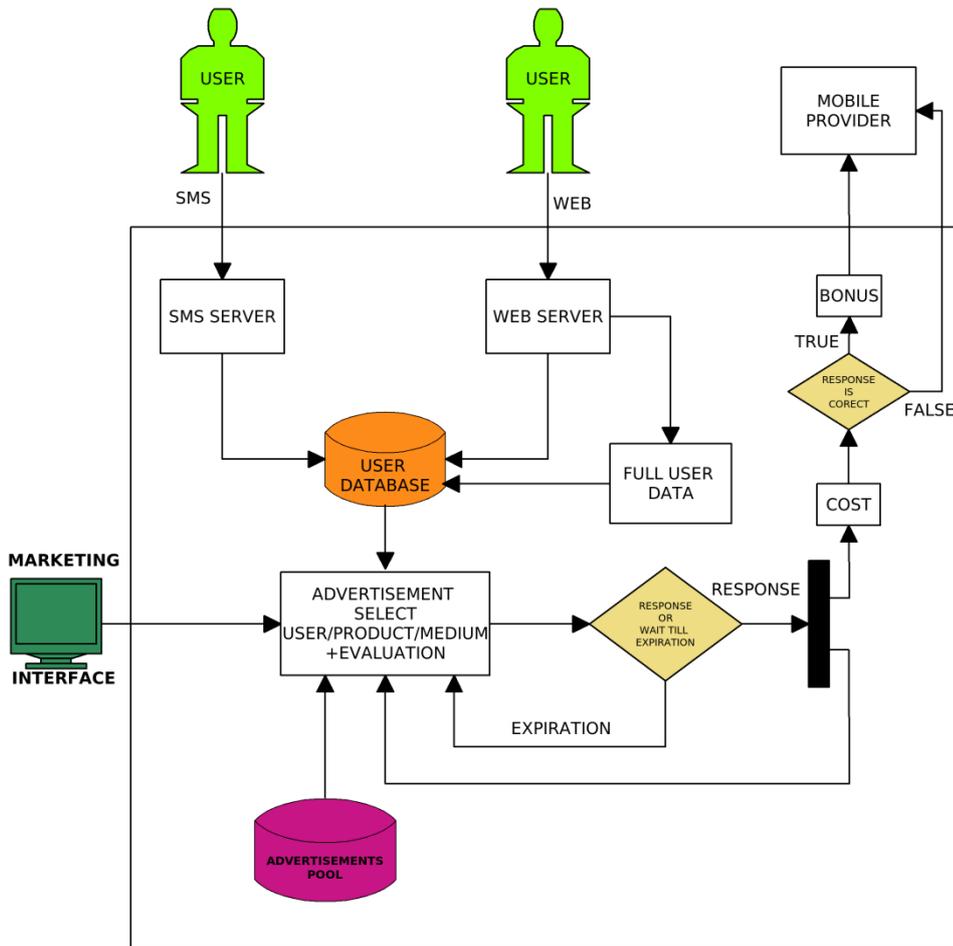

Figure 1. *The data flow diagram describes the advertising process that results either in the user earning bonus credit or covering their false response costs.*

The second container introduces messages in MMS format, which in turn display a typical audiovisual-driven advertisement. A correct response under this case may be flexibly sent either with an SMS or a responding MMS. In the latter case, a typical example involves an advertising campaign that may request the user to send back an image, sound or video in an attempt to create an audiovisual logo or advertisement of a product based entirely on user-images.

The third container type involves execution of a computer program, or visiting a website via the browser function of the mobile device. Winning a level of an interactive advertising game generates a code that is then sent back to the server, enabling the reward to be awarded. Figure 1 schematically depicts the data flow diagram described in the above process.

2.3 Security Issues

The system guarantees through the database that each message is sent in the appropriate format, as for the device capabilities are known and may be tested for each mobile phone type. This permits users with devices featuring variable technical specifications to view and respond by utilising their device capabilities in full. The system is designed to allow users to update their profiles via a web interface. They may control

their accounts; enter personal interests and other relevant information updating automatically the database, while aiding to increase the system security and avoid the transmission of unwanted messages.

An important system-specific security issue with cost implications that needs to be addressed is to identify that the users successfully receive and view the message, before they are rewarded. Take for example a user that due to mobile device malfunction or accidental key-presses due to a stuck keypad responds incorrectly in every message sent. This is clearly an issue that may introduce increased advertising cost. A solution to this problem is to set a limit of continuous erroneous responses, after which the user is automatically excluded from the system. Therefore analysis of the system's integrity and security is important to be examined at every stage of the process.

3   SWOT ANALYSIS AND COST ISSUES

Strengths	Weaknesses
Ensured feedback Increased audience targeting ability Increased participation of the audience Increased Value for Money Unwanted communication is prevented	Increased cost of advertisement compared to similar solutions (balances via the Value for Money factor)
Opportunities The present proposal could produce a strong competitive advantage for a company or organisation against its competitors. Benefit from marketing revenue pulled from television, print and radio toward more measurable, user-directed advertising that guarantees The user takes up an active role and interacts dynamically with the advertiser The system supports various types of rewards that may be adjusted to each user interests	**Threats** It becomes more difficult for multimedia companies to provide a consistent experience across different browsers and the ever-expanding variety of handsets and personal devices in the market. Users may be sceptic to use this technology as SMS fraud and high charges are not uncommon in the market.

Table 1.   SWOT analysis describing the principal strengths, weaknesses, opportunities and threats that are introduced with the proposed interactive advertising system.

The authors are confident that the increased cost of advertising balances out essentially as the nature of this particular type of interactive advertising demonstrates many parallel advantages. These include: the fact that an advertising agency may beforehand calculate the desired cost of the promotion based on the type of advertisement; it is possible to select particular target groups in advance; each user may be rewarded individually; users may be targeted directly from their own provider in order to strengthen their loyalty programme and reward them, other products may combine this type of advertising with their own products and reward infrastructure. The SWOT analysis shown in Table 2 is used as a first evaluation in comparison with existing marketing methods.

When considering the cost using the local tariffs, it is estimated that an average reward equal to the cost of an SMS, MMS and JAVA application will suffice to reward the users under normal conditions. This may not apply to those advertising campaigns that will use an interactive JAVA application to respond to the advertisement doing use of the mobiles inputs such as the keyboard or the microphone. For instance in a JAVA type advertisement the users may be asked to play an advertising game where in addition to the basic

reward there is the opportunity to earn extra credit according to their score performance. The transaction cost and charges have to be agreed individually with each mobile communication provider.

4   OPTIMIZATION OF THE ADVERTISING PROCESS

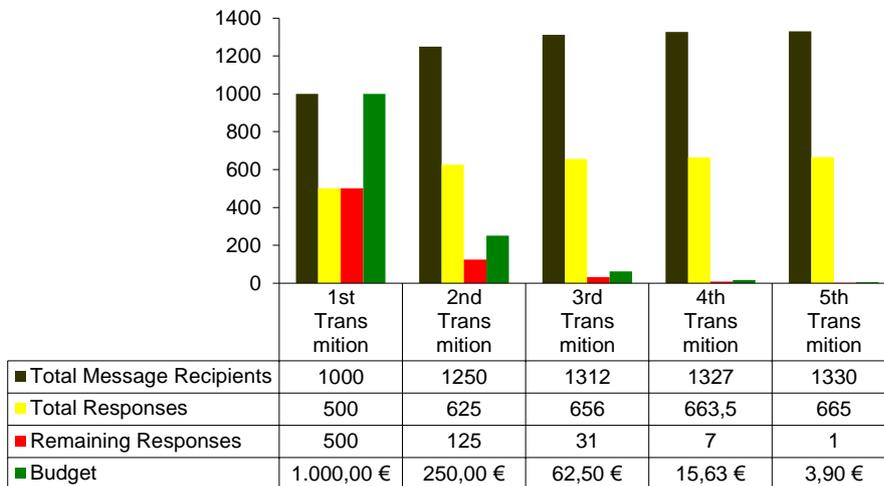|	1st Trans mition	2nd Trans mition	3rd Trans mition	4th Trans mition	5th Trans mition
■ Total Message Recipients	1000	1250	1312	1327	1330
■ Total Responses	500	625	656	663,5	665
■ Remaining Responses	500	125	31	7	1
■ Budget	1.000,00 €	250,00 €	62,50 €	15,63 €	3,90 €

Figure 2.   Chart Diagram showcasing an advertisements life cycle under certain hypotheses.

In Figure 2 a theoretical case-study is presented, depicting how the proposed model can be adjusted temporally based on user feedback in order to optimise the advertising cost through the dynamically adjustable redirection of advertising content. The figure presents the cost performance of an advertisement cycle for a theoretical case. The proposed model optimises the whole advertising process through the dynamic redirection and selective targeting of the advertisements receivers, based on the feedback supplied by the interaction feature. For each transmission cycle, the total messages sent are displayed on the first line and the number of responses for each of these messages is recorded on the second line. The third line displays the remaining responses and finally the fourth is used to present the remaining funds. This type of presentation may be used to interactively calculate the advertising campaign at each stage.

A company decides to run an advertising campaign using the interactive mobile advertising model. The following numbers are only used hypothetically, to present the case more clearly. The company's budget is set to 1000€. We assume that the positive feedback will be 50% of the total recipients each time. The transmission cost will be 0,5€ per recipient and the reward for correctly responding to the content will also be 0,5€, totalling a cost of 1€ per complete transaction. For every transmission of the advertisement 1/2 of the budget is consumed for the transmission cost and 1/4 is consumed to reward the correct responses. The excessive 1/4 can then be reused to support a new transmission. This routine can continue till the budget becomes less than the total cost of a single transmission. The above may be expressed via the use of a generalised equation shown below that describes the system's efficiency:

$$Rr = \frac{C - (C \times Tc / Ac) - \mathrm{Re}\,C}{Rc / Ac} \text{ for } (Ac \leq \mathrm{Re}\,C \leq C)$$

Equation 1.   Efficiency equation where Rr= Response rate, C= Capital, Ac(Advertisement cost)=Tc(Transaction cost)-Rc(Reword cost) – Advertisement cost per single transaction including the event of rewarding the user, ReC= Remaining capital

The proposed adaptive strategy alters dynamically the advertising performance enabling further transmission of advertisements to new users by taking advantage of the remaining capital. In case a campaign achieves a high response rate, only a small amount of the starting capital will be left for further reuse, but the campaign will certainly have met it's goal to reach the audience efficiently. On the other hand if the total response is low, a significant amount of the starting capital will still be available for further use. This enables more users to be targeted dynamically, simulating a form of direct advertising. In the worst case scenario where no user will respond, the message will have reached double the number of intended recipients. In practical terms this implies that the advertisement cost is still the same with any other form of mobile advertising.

5   CONCLUSION

Mobile phones have become personal media devices that users depend on for communication, work, social interaction and entertainment. They are used as hybrid devices combining various services such as image and video capture, music reproduction, audio recording, personal organisers and agendas and for Internet access. Never before has a communications device been so close and trusted by the user. The intimate nature of the relationship between users and their mobile devices demands advanced understanding and research from businesses in order to successfully deliver advertising content and achieve a high rate of infiltration.

An inappropriate advertisement delivered at an inappropriate time to the wrong user is a waste of resources and opportunity. This paper introduced a novel advertising interactive multimedia advertising system that may be used for multiple purposes, is adjustable and outperforms traditional forms of traditional mobile advertising, while it prevents unwanted communication. This renders the proposed technology a practical platform for development.

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