CSCoupons: Applying Context-Sensitivity to Increase Fast Food Advertising Usefulness

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ABSTRACT
Companies spend too much money on advertising in order to improve their sales. However, the ratio between investment and effective sales is low. Increasing the usefulness of provided ads and discount coupons is an ongoing challenge in advertising, in order to enhance return on investments, reducing wastage and increasing revenue. Ubiquitous computing offers many features that are considered compliant to advertising needs. A key aspect in ubiquitous computing is the use of context to provide more relevant information to users, according to their current situation and environment. This paper introduces CSCoupons, a mobile context-sensitive system to deliver discount coupons. We conduct an experiment with a developed prototype of CSCoupons to assess the ideas about fast food coupons in shopping malls. To measure the usefulness of delivered discount coupons, we compared two versions of the prototype: with and without considering context information. The preliminary results show context-sensitivity highly increases advertising usefulness.

Categories and Subject Descriptors
H.3.4 [**Information Systems**]: Systems and Software – *User profiles and alert services.*

J.1 [**Computer Applications**]: Administrative Data Processing – *Marketing.*

General Terms
Measurement, Experimentation

Keywords
Context-aware computing, ubiquitous advertising, ubiquitous computing, mobile computing

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1. INTRODUCTION
It is estimated that less than a half of resources applied in advertising effectively promotes sale of products and services [8]. John Wanamaker, a department store owner and pioneer in marketing [11], said that he knew that half of the invested money on advertising was wasted, but his problem was he didn't know which half. Therefore, increasing advertising usefulness is an ongoing challenge for researchers and professionals in the advertising industry.

A study conducted in the United States and presented in 2006 estimated that only 41% of what is spent on advertising generates sales [8]. It is necessary to spend continuous efforts in order to discover ways to increase the sales [7], knowing how useful ads can be, in other words, to know ads usefulness, i.e. capability to produce a sale.

Researchers [9] have employed efforts to promote alignment between ubiquitous computing (UC) and advertising, given the fact that the results produced by the first area reveal themselves useful to meet the challenges of the second.

In this work, we focused a specific class of advertisements - offers, in form of discount coupons - and how the use of context can make them more useful to customers.

Research in the area of discount coupons on mobile platforms are scarce [3], even more if we seek context sensitivity. In industry, in the other hand, there are many websites and mobile applications for discount coupons delivery, although contextual information is underexplored (as seen in collective buying systems).

We projected and introduce CSCoupons, a mobile application for context-sensitive discount coupons delivery. The domain for this experiment is discount coupons for fast food restaurants. We performed the context modelling and implemented a prototypical mobile application for coupons delivery simulation. In order to measure the gain obtained on using context in this field, a second prototypical application was implemented for discount coupons delivery, but without context-sensitivity. The usefulness of offers submitted in both cases are measurable and the results intend to demonstrate if the context-sensitive approach is more effective.

The paper is organized as follows: Section 2 presents some concepts; Section 3 reviews similar works; Section 4 introduces CSCoupons; Section 5 shows an experimental evaluation; and Section 6 presents our conclusions and further work.

2. CONCEPTS

The original vision of ubiquitous computing pointed to advances in hardware and software that would support an entire embedded systems universe, spread in connected devices, surrounding us by hundreds, so integrated into our day-to-day that technology will "disappear" [14]. A fundamental challenge in this scenario is to develop "calm technologies" (that inform and calm), where computers act both on focus and on peripheral of human attention, making information transit easily between these two areas [15].

Context-sensibility is a core aspect of ubiquitous computing [10] [1]. Context-sensitive systems are applications that use context to adapt its behavior in different situations or circumstances, promoting more relevant services to users or information to better support tasks performance [12].

Ubiquitous advertising, or pervasive advertising, is the given name for the use of ubiquitous computing technologies for advertising purposes [9]. Ubiquitous advertising is faced as the killer application for the 21st century [6]. Indeed, advertising and UC have approached on the perception that the former has challenges and goals broadly aligned with what has been researched in the second.

Among the main problems that advertising faces are targeting advertising and evaluating ads effectiveness. An interesting aspect of ubiquitous advertising is that a trigger for shopping should be, at the same time, calm and engaging: ubiquitous advertising is supposed do be calm when we don't need it, but engaging and inspiring when we want it [9].

Based on the relevance and usefulness degrees presented in [9], we consider there are three main ways to look at results of exposing a consumer to an ad: *Irrelevant*: the ad doesn't get customer's interest; *Relevant but useless*: the ad gets customer's interest, but it doesn't generate a sale; *Useful*: the ad gets customer's interest and it generates a sale.

About the buying behavior patterns of consumers, there are four categories [9]: *extensive decisions* (demand high cognitive and emotional involvement, take time to be taken, such as the purchase of a house); *habitualized purchase decisions* (almost automatic or routine decision process); *limited decisions* (taken when there is no choices); and *impulsive purchase decisions* (strongly driven by emotions). In the *impulsive purchase decisions* category, what happens is the realization of a stimulus to which the consumer responds with a purchase – a trivial example of stimulus is a promotional offer. A contemporary phenomenon that exploits this behavior is the collective shopping sites – most of them also available on smartphones and tablets.

3. RELATED WORK

As context-sensitive coupons delivery systems are not wide explored [3], we reviewed two similar studies on mobile advertisement area.

Tag Match Advertising [4] (TMA) is a proposal that mixes RFID readers and location services embedded in smartphones to enrich the information about products and services, offering georeferenced advertising. Its approach seeks to take one of Internet advertising model (where the user search for information and receives, in addition to content, advertising) to the mobile environment.

AdNext [5] is an ubiquitous advertising system based on discovery of visiting patterns in a shopping mall to identify which is the most probably "next place" that a customer will visit, in order to support delivery of more relevant ads to customers. Their strategy aims to increase the relevance of the ads by discarding those that will not probably be interesting (e.g. an advertisement for a restaurant delivered minutes after the user have had lunch). The mechanism for learning visiting patterns is collective, i.e. it is based on data provided by many users, obtained with techniques for identifying indoor location using Wi-Fi networks. This approach incorporates the use of a learning pattern technique to acknowledge user's sequential patterns.

Both TMA and AdNext use only users locations as contextual element (actually AdNext uses a learning machine approach to predict user location and try to infer user current needs).

Indeed, user location is relevant for ad's delivery. The use of location - and the consequent development of location-aware applications - is increasing and becoming more widespread among smartphone users. In United States, 50% of adults and 75% of all users use location based services in theirs mobile devices [16].

However, consumer context has much more to offer in order to make ads more useful (e.g., customer's habits, preferences, restrictions etc.).

4. CSCoupons: CONTEXT-SENSITIVE OFFERS DELIVERY

This work proposes CSCoupons (*Context-Sensitive Coupons*), an ubiquitous and context-sensitive offers delivery platform for mobile devices. We seek to investigate in which ways ubiquitous computing techniques can support the ad's usefulness problem. As a motivating scenario, for the current version of our proposal, we consider the domain of discount coupons delivered in fast food restaurants area in shopping malls. CSCoupons is a mobile application that presents daily discount coupons to users, according to variations observed in his/her context. We seek to assess whether context-sensibility increases the offers usefulness – and how much it does. Offers usefulness is measured by the coupons redemption's rate.

Next subsections discuss the proposed context model, the CSCoupons architecture and the aspects concerning the implementation of two versions of prototypical application: with and without context sensitivity.

4.1 Context Model

For modeling a context-sensitive system, it is important to identify what is considered "focus of attention" [2][13], which involves recognizing the *actor* performing a *task* that can be enriched through using context. In CSCoupons, the *actor* is the consumer (ad's target) whose task is to find a fast food restaurants to lunch in shopping malls. Table 1 shows the CSCoupons context model, according to this focus of attention.

Three entities were identified: Consumer, Restaurant and Coupon. For each entity we indicate the considered contextual elements raised during the problem analysis. Contextual elements can be static (doesn't change over time), dynamic (changes over time), explicit (informed by the user) and implicit (obtained without user intervention).

4.2 Architecture

CSCoupons architecture are divided in two parts: server side (general software infrastructure to support context-sensitive coupons delivery) and mobile client side (specific features for mobile deployments). We organized them as shown in Figure 1.

The very core of CSCoupons architecture is the server side *Context Manager* module. It implements a submodule called *acquiring context* to receive coupons data (local, date, features) generated by advertisers (for the purpose of gather customer data, there is another *acquiring module* in the mobile client side). The submodule *processing context* transforms raw data into meaningful context data, in order to get a context-sensitive coupon. This context-sensitive coupon is delivered to customers by the *notifier* submodule.

Table 1. CSCoupons context model

Entity	Contextual Element	Static	Dynamic	Explicit	Implicit
Consumer	Sex Gender	X		X	
Consumer	Birthday	X		X	
Consumer	Preferred kind of food	X		X	
Consumer	Preferred payment method	X		X	
Consumer	Location		X		X
Consumer	Time		X		X
Consumer	Have lunched?		X		X
Restaurant	Location	X		X	
Restaurant	Accepted Payment method	X		X	
Restaurant	Kind of food	X		X	
Restaurant	Evaluation		X	X	
Coupon	Price	X		X	
Coupon	Expiration	X		X	
Coupon	Kind of food	X		X	

4.3 Prototype Implementation

Two prototypical applications for fast food discount coupons were developed: CSCoupons and SimpleCoupons. The CSCoupons is context-sensitive, so it implements the context model and architecture presented in previous sections. The SimpleCoupons was developed to support the experimental studies (Section 5) and does not consider context changes. It shows at startup a discount coupon offer (identified randomly). Both applications produce only one coupon per day, so after accepting or refusing an offer, no more coupons will be available until the end of the day (when the coupon expires).

The developed prototypes are mobile applications built on the Android platform. We choose Android because it is an open platform, widely used on most mobile smartphone devices, easing application distribution for the experiment.

In its current version, CSCoupons considers a subset of the contextual elements presented in Table 1: user's preferred kind of food, user and restaurant's locations, current time and offer's kind of food.

CSCoupons checks, near lunchtime (between 11:00am and 2:00pm), if the smartphone holder is near a shopping mall (where several fast food options can be found). If so, it notifies the user with a discount coupon offering for a restaurant in that shopping whose available offer is compatible with user's food preferences. The coupon is valid only for the day it is delivered.

When the application starts, CSCoupons verifies if the device's location services are active – if they are not, it asks for activation.

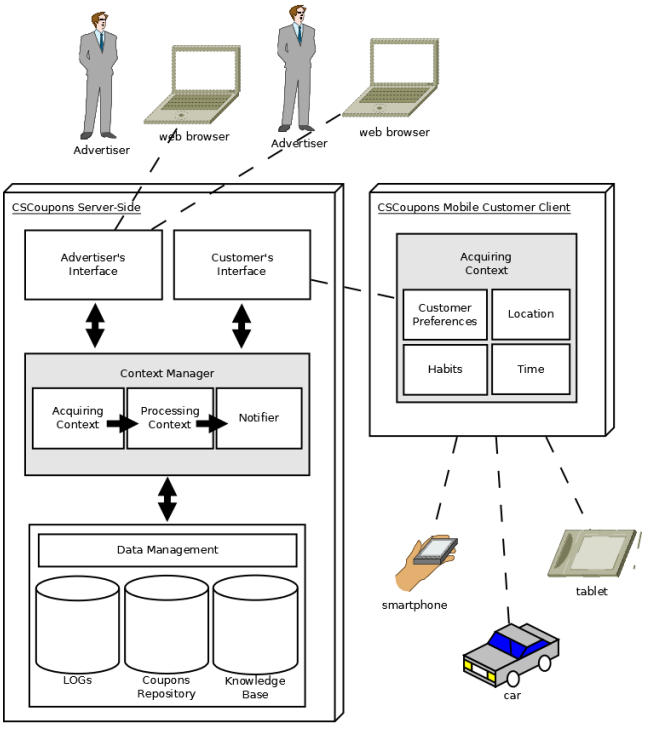

Figure 1. CSCoupons Architecture

Proximity between user and shopping malls is verified through location services embedded in customer's smartphone. These services use Wi-Fi networks, mobile networks and GPS satellites.

The first time the software is launched, it displays a screen for the user to configure his/her food preferences (pasta, meat, and so on). CSCoupons does not require any user interaction until the application identifies an offer and notifies the user about it. In Android OS, offer notifications are presented in the notification bar. When the user opens a notification, a new screen appears describing the coupon (restaurant, address, kind of food, discount value). The consumer has two options: to accept or to refuse the offer. Every time an user accepts (or refuses) an offer, a log record is inserted.

The second version of the prototype, without context-sensitivity (SimpleCoupons), does not generate automatic offers notification. When it is raised, a discount coupon offering is shown for a fast food restaurant and the application ends. As done in CSCoupons, acceptances and refusals are recorded in a log.

5. EXPERIMENTAL EVALUATIONS

To evaluate our proposal we performed with 5 (five) volunteers a preliminary experimental study in the city of Salvador/BA during a seven-day period. SimpleCoupons was given to 1 (one) volunteer while another 4 (four) volunteers used CSCoupons. In both cases, they received textual instructions about how to use the programs. All participants live in Salvador/BA, are male and have between 25 and 34 years old.

A list of 294 simulated discount coupons was manually generated. It was loaded and stored on the mobile devices during the applications' installation time. This number represents the number of mapped shopping malls (6) times the number of kinds of food we defined (7) times the number of days of the experiment (7), i.e., there was one coupon for each shopping mall, for each kind of food, for each day.

At the end of the seven-day period of the experiment, log files were collected from volunteers' devices. The log records date and time of coupons offering, and the consumer's decision (accept or refuse). The offer's usefulness for a volunteer *i* (Ui) is given by the ratio between the amount of coupons accepted (Ai) and the total generated offerings for that volunteer (Oi). Offers that do not have any record of acceptance or refusal are ignored. In these cases, the user probably was notified but ignored it.

$$Ui = Ai / Oi \quad (1)$$

The offers's usefulness for each application (OUi) is given by the sum of offers's usefulness for each participant *i* in the experiment with the application, divided by the total number *n* of volunteers using the application.

$$OUi = \sum_{i=1}^{n} Ui / n \quad (2)$$

Although we admit that sample is not yet sufficiently representative, parcial finds are pointing to our expectations. Preliminary results indicate less coupons offering but more acceptance of coupons in the context-sensitive featured application, what suggest a calmest and more useful user experience. While SimpleCoupons ensures one coupon daily, CSCoupons relies on time rules (lunchtime), space rules (proximity to shopping malls) and user preferences.

The usefulness of the coupons discount was higher in the context-sensitive featured prototype: 71% of CSCoupons discount coupons were accepted (therefore considered useful), while only 20% of the offers did not observe context were accepted.

6. CONCLUSIONS AND FURTHER WORK

This paper discusses the opportunity to increase the usefulness rate of advertisements through features of ubiquitous computing. For this, it was developed a study on offers for fast food restaurants and it was proposed CSCoupons, a context-sensitive mobile application for discount coupons delivery for fast food restaurants.

We presented CSCoupons' context model and architecture and discussed the implementation aspects of a preliminary prototype of the system as well as the preliminary results with an experimental study performed in the city of Salvador-BA.

In order to evaluate the gain promoted by the use of context in the distribution of fast food discount coupons, a prototype similar to CSCoupons was developed, however without use of any contextual element. We performed an experiment to compare the usefulness of offers in these two applications.

The preliminary results suggest the advantage on using context to deliver discount coupons for fast food restaurants.

As ongoing work we indicate the following (i) the execution of the planned experiment with more users during a longer period of time in closest to real conditions (restaurants, offers, consumers); (ii) the evolution and implementation of the modules described for the proposed architecture, including the overall distribution chain from the offer creation by the advertiser to the use of the coupon by the user; (iii) the incorporation of more contextual elements processing into the application and evaluating how the incorporation of each new contextual element can contribute to the growth in the offers' usefulness.

As opportunity for future work we indicate the use of machine learning techniques to provide more implicit than explicit entries of contextual elements. Providing personalized services involves discovering user's habits and preferences, which can change over time [1]. We do believe it leads to a calmest, pleasant and, therefore, useful user experience. For instance, not annoying consumers with things that do not matter to him/her, perceiving him/her in a non intrusive way and engaging him/her in opportunities only at the best time, location and for best reason.

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