

# A SYSTEM FOR MOBILE AND WIRELESS ADVERTISING

*Personalized information as incentive for receiving advertisement on mobile terminals*

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**Abstract:** Mobile terminals are an interesting medium for advertising because of the high penetration rates and their character as personal communication devices. Since advertising in general has the reputation of being something annoying there has to be some kind of incentive mechanism to obtain permission from the consumers for advertising on their mobile terminals. The MoMa-system for mobile and wireless advertising described in the following article focuses on personalized information as such an incentive mechanism. For the provision of personalized information a system requires personal data like profile information and the current location of an user. But there are privacy concerns when providing such information for a mobile advertising application, of course. Thus we designed MoMa in a way to realize both of this conflicting requirement: personalized information and guaranteeing data protection.

**Keywords:** Mobile and wireless advertising, context sensitive mobile applications, data protection

## 1. INTRODUCTION

Advertising is defined as making a representation in any form in connection with trade, business, craft or profession in order to promote the supply of goods or services, including immovable property, rights and obligations (directive 84/450 of the European Economic Community). Kotler and Bliemel's (1992) definition of advertising comprehends a paid and non-

personal representation. Based on these definitions mobile or wireless advertising is advertising using mobile terminals as medium. While some authors consider on-board vehicle computers or notebooks as mobile terminals, we restrict ourselves to mobile handheld devices like cellular phones, PDAs and smartphones. Notebooks and on-board computers don't have the ubiquitous character of handheld devices: one doesn't carry his notebook with him all day, and even if one does, it won't be turned on all the time (Turowski and Pousttchi, 2004).

Mobile advertising can be seen as advancement of digital- or internet-advertising, since both have special features in common which are valuable for advertising purposes; but the ubiquitous character of mobile terminals even increases the potential of these features.

Although the term "mobile advertising" (e.g. Barwise and Strong, 2002) as well as "wireless advertising" (e.g. Yunos et al, 2003; Wohlfahrt, 2001; or the Wireless Advertising Association) can be found in literature, strictly speaking one should use the term "mobile *and* wireless advertising" (figure 1), since "mobile" and "wireless" are orthogonal concepts (Wang, 2003): if a device is mobile (one can easily move it) or not doesn't imply if its data connection is wireless or wired. An ordinary desktop PC (not mobile) might be connected to the internet via Ethernet (wired) or using wireless technologies like WiFi or WiMAX because someone doesn't want to lay cables in the whole house respective there is no cable for broadband internet access available in his street. A notebook or a simple PDA without WiFi or Bluetooth capabilities are examples for wired mobile devices. Services like the one by AvantGo (avantgo.com) show that these kinds of devices can also be used as medium for advertising: using AvantGo owners of PDAs can download web pages from the ordinary internet for offline reading and sync them to their devices; the pages are transcoded to be readable on small PDAs and adverts are added. For the sake of simplicity we will use the term "mobile advertising" when we actually mean "mobile and wireless advertising".

The rest of this article is organized as follows: in the second chapter we discuss selected aspects of mobile advertising. Chapter number three describes the MoMa-system, which was developed during the project "MoMa — Mobile Marketing" funded by the Federal Ministry of Economics and Labour of Germany. The last chapter gives a summary.

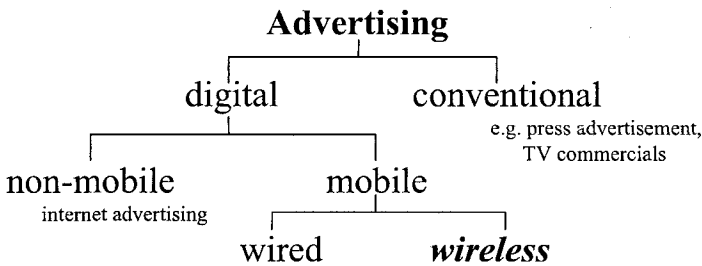


Figure 1. Different methods of advertising

## 2. MOBILE ADVERTISING

### 2.1 Potentials of Mobile Advertising

Mobile terminals are an interesting target platform for advertising because of the high penetration rates: in many countries the penetration rate exceeds the 90 % mark, there are even countries like Sweden and Italy with mobile penetration rates over 100 % (Netsize, 2005). The global number of mobile subscriptions is expected to pass the number of two billions during 2005, and approaching 3 billions by the end of the decade (Informa Telecoms & Media, 2005). Also they are no longer considered as extraordinary gadgets but as commonplace household commodities.

People carry their mobile device with them most of the day, seldom lend it away and don't share it with other people (which is quite common for other communication devices, e.g. one telephone or TV set for the whole family), so using mobile technologies advertisers can reach people almost anytime and anywhere. During the pretest for an acceptance study for a mobile service we asked the participants (N=28) how many hours a day on average they are reachable via their cellular phone, and the mean value of the answers was  $\approx 20.7$  h/day (deviation  $\approx 5.1$ ), whereas  $\approx 56$  % stated "24 h". Using conventional advertising methods a marketer can reach his audience only in certain situations and moments, e.g. after work in front of the TV set when using commercials.

Mobile advertising can be seen as advancement of internet advertising, whereas the market volume in 2004 for the latter is estimated to be as high as 9.6 billion US \$ alone for the US-market (IAB, 2005). Both share the

following features, but the ubiquitous and personal character of mobile devices even increases the advertising potentials provided by these features:

- **Individually addressable:** Mobile terminals can be addressed individually (using the mobile phone number), so personalized and target-oriented advertising can be realized. This is also the case for internet advertising (using the e-Mail- or IP-address). Using conventional advertising methods the advertiser has to broadcast his message to an anonymous crowd of people (e.g. audience of a TV commercial or readership of a newspaper or magazine) so many people are reached that are not in the intended target audience. Advertising messages on mobile terminals are hard to ignore when using push-mode communication (e.g. SMS/MMS or text-to-speech).
- **Interactive:** Internet and mobile advertising can be interactive. One can request further information, participate in a sweepstake or forward the message to friends without changing the medium (e.g. when sent as e-mail or SMS). Especially “forward a message to friends” is an interesting opportunity from a marketing point of view; there are even campaigns with the aim to stimulate a “viral”- or “word-of-mouth”-effect (e.g. “Wella Virtual Kiss”, Mohr et al, 2003): an advertisement message is passed to a consumer by another consumer, not by the advertiser directly (Helm, 2000). Viral marketing is supposed to provide a dissemination of adverts with exponential growth and it is assumed that consumers have more confidence in advertisement messages received from friends rather than firms; there are special systems for mobile advertising following the idea of “viral marketing” (Straub and Heinemann, 2004; Ratsimor et al., 2003) using multihop ad hoc networks without infrastructure (so called MANETs, see Toh (2002)). Also the response rates reported for mobile advertising are very promising (Kavassalis et al., 2002; Schwarz, 2001), many users respond within a few minutes after they received an advert (Barwise and Strong, 2002).
- **Multimedia capabilities:** internet advertising may make use of multimedia content like pictures, jingles, sounds, animated graphics and movie sequences. This is very important for advertising since many marketers use such elements to create brand awareness. Many mobile terminals used today already can display multimedia content.

A special feature of mobile services is context awareness: Context sensitive applications use information about the situation of an user to adapt themselves according to his needs in that situation (Schilit et al., 1994; Chen and Kotz, 2000). The most prominent example for context information concerning mobile applications is “location”. Technically the information about the current location of an end user respective his mobile device can be

retrieved using a receiver for the signal of the global positioning system (GPS), referring to the location of the nearest base station (cell-of-origin) or combining both methods to obtain “assisted GPS”. The “time difference of arrival”-method (TDOA) calculates the current position referring to the observed time difference of arrival of radio signals from several base stations (Zeimpekis et al., 2003). Applying the idea of location based services (LBS) to advertising one could provide an user with advertisement concerning facilities not far away from his current location (Aalto et al., 2004; Kölmel and Alexakis, 2002) or even suggest a route to get there (Ververidis and Polyzos, 2002). But “location” is just one example for context information; there are many other examples like time or weather and MoMa is designed to handle all kinds of thinkable context parameters. The usage of context information is very important when designing a mobile application, because mobile terminals have a limited user interface (no real keyboard, small screen) and thus it is import to decrease the amount of information that has to be entered by the user to use a mobile service.

The “honeymoon effect” — people are interested in new (technical) things — could also help to establish mobile advertising.

## **2.2 Challenges of Mobile Advertising**

In the last subchapter we discussed the potentials or advantages of mobile terminals as advertising platform. But there are also big challenges when talking about mobile advertising:

Since mobile advertising can be seen as advancement of internet advertising there is the concern that the huge wave of Spam messages known from e-mail-communication spills over to mobile devices. Spam is defined as an unsolicited electronic bulk message with commercial intent (OECD, 2004). There are studies that state values of more than 70 % for the portion of spam message in e-mail-communication, for example MessageLabs (2004). Another study by bmd wireless and the University of St. Gallen (2005) found out that 80 % of the people questioned already received Spam messages on their cellular phones. Besides spam messages there are other kinds of unsolicited messages: messages which pretend to be personal messages and ask the user to call back to a certain number (which is in fact premium rate number), contain a virus or which change the configuration of the handset.

Unsolicited messages for mobile terminals are an even bigger problem than for desktop PCs because of the limited resources and the personal or even intimate nature of mobile devices; most mobile devices haven’t enough memory to store a lot of unsolicited messages or don’t have the computation power necessary for running a spam filter. As our mentioned pretest-study

implies there are a lot of people who never turn off their cellular phone, so an unsolicited message could even disturb their sleep.

There are also some special challenges for mobile advertising due to the nature of mobile terminals:

- **Limited user interface:** Due to their limited size and weight mobile terminals have a limited user interface: they have a small display with a low resolution and color depth and don't have a full keyboard, so users don't want to enter a lot of data and advertising messages have to be designed in a way to be displayable in a reasonable way on mobile terminals. We consider context information as discussed above as a way to relieve the user of entering more data than necessary.
- **Limited resources:** mobile terminals don't have big resources with regard to bandwidth, calculation power, memory and — probably the worst problem — battery power.
- **Expenses of mobile data communication:** mobile data communication is still very expensive, e.g. about one Euro for 1 Mbyte data traffic (cleared in blocks of 10 or even 100 KByte) when using GPRS or UMTS (prepaid rates are even much more expensive), so many people don't use mobile devices for research on product and services. Also nobody wants to pay for the reception of advertisement.
- **Privacy concerns:** People store sensitive data on their mobile devices (e.g. address book, calendar, personal notes) and it is possible to track their location (see the discussion for location based services in section 2.1), so it's no wonder that there are privacy concerns, e.g. Barkhuss and Dey (2003). There are also laws which ask for data protection, e.g. directive 95/46/EC of the European Economic Community.
- **Different types of mobile terminals:** There is a plethora of different types of mobile terminals on the market, all with different capabilities with regard to color or monochrome display, display size and resolution, devices for data input; see the WURFL (2005) project, which maintains an open database with specifications of many different mobile devices. An advert that looks great on one type of device may look terrible on another one (if presentable at all). When developing a mobile application there are high costs caused for testing and porting the application to different types of terminals; these costs often exceed the costs for the actual implementation (Schlickum, 2005).

### **3. THE MOMA SYSTEM**

#### **3.1 Basic Principle**

A fundamental concept in mobile advertising due to the experience with unsolicited direct advertising — in particular spam-e-Mail and telephone calls (“cold calls”) — is permission marketing (Godin, 1999; Krishnamurthy, 2001): consumers will only receive ads after they have explicitly expressed their allowance; they can opt-out anytime if they no longer want to receive advertisement, of course. In many countries permission marketing is the only legal way of direct advertising (e.g. article 13 of the directive 2002/57/EC of the European Union). Permission marketing also asks for personalized ads which fit the fields of interest (profile) of the consumer.

There is one hitch with the concept of permission marketing: a consumer has to know about a brand or firm to give explicitly allowance for receiving their adverts. So firms have to employ conventional methods of advertising (e.g. TV commercials) to “invite” consumers for participation in a mobile advertising campaign (Kavassalis et al., 2003). For this reason mobile advertising is often integrated in bigger campaigns, see Bauer et al. (2005) for examples. However, small enterprises don’t have the resources to do this.

To realize permission based mobile advertising also affordable for small enterprises we designed MoMa as mediator between advertisers and end users (see figure 2): on the right side of the system advertisers put “offers” into the system. These offers are formulated according to a “catalogue” which is a tree of product and services categories. Each category is specified by certain attributes and inherits attributes of its parent. For example “gastronomy” with the attribute “price level” has “pubs”, “restaurants” and “catering services” as child categories. On the left side of the system the end users submit “orders” to MoMa using a special client application on his mobile device; there are client applications for different types of mobile programming platforms (J2ME, Symbian). These orders are also formulated according to the catalogue and may include profile and private context information.

The matching-component of MoMa tries to find fitting orders and offers; for this process public context information may be requested from special context providers. If matches are found the end users of the order is notified (but not the advertisers!). These notifications are delivered using the channel defined in the end user’s notification profile; such a notification profile describes how (SMS, MMS, e-mail, text-to-speech) and to which end address he wants to be notified. Different channels and end addresses can be

used depending on the time, e.g. e-Mail during bedtime, SMS to phone number A from 8 to 9 a.m and to phone number B from 3 to 4 p.m.

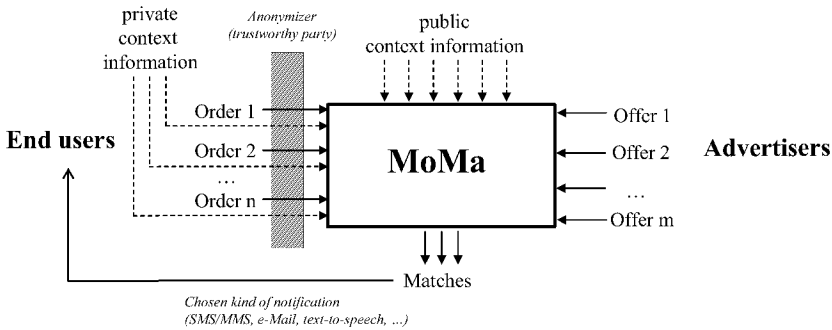


Figure 2. Basic principle of the MoMa-system

### 3.2 System Details

Each end user (consumer) of the MoMa-systems (see figure 3) needs an account with an unique user-ID and at least one general and one notification profile. In the general profile information about the user (age, marital status, ...) and his fields of interests are stored. A notification profile holds at least one end address of an user (e-mail-address, mobile phone number, ...); in the case of multiple end addresses the user can specify, what end address at what time interval has to be used for notification. Both profiles can be stored on a server and can be synchronized with different terminals an user may own.

When creating an order X the user has to choose a category from the catalogue and to fill in the needed attributes. If possible values for attributes will be looked up in the general profile (e.g. number of children when looking for hotel accommodation) or the available private context parameters (e.g. location). Please note: the order X does *not* contain information about the identity or the end addresses of an user.

The completed order X together with the user-ID (UID) and the number of the chosen notification profile (NID) are submitted to the anonymizer component of the trustworthy party. Appending a random bit string *rand* the anonymizer encrypts this and obtains a cipher text  $C = \text{crypt}(\text{UID}, \text{NID}, \text{rand})$ . The random data included ensures that even when using the same ID and notification profile number multiple times we obtain a different cipher text. The pair  $\{X, C\}$  is then forwarded to the core component of the MoMa-system, which cannot decrypt C. This C can be seen as transaction



pseudonym, a pseudonym that is only used for one transaction and thus represents the most secure level of pseudonymity (Pfitzmann and Köhntopp, 2000).

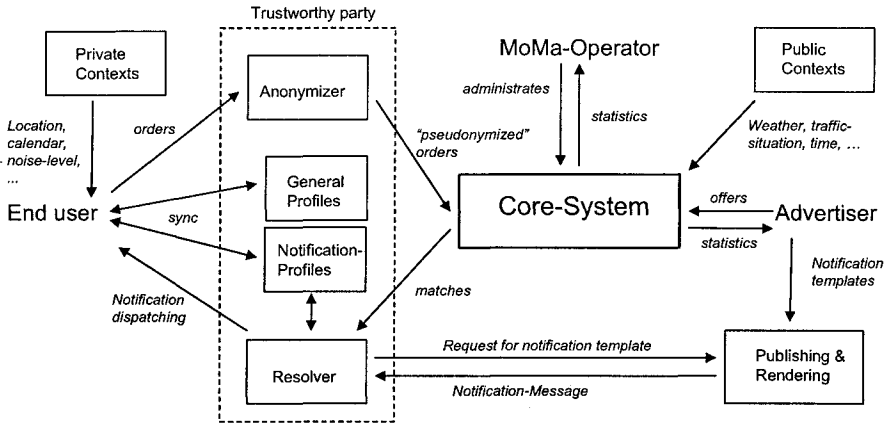


Figure 3. Architecture of the MoMa-system

On the other side the advertiser defines his offer Y according to the catalogue and submits it to the core component directly. He also has to create templates for the notification of end users concerning his offer Y and deposit them on the publishing & rendering server.

Within the core component of the MoMa system the matching server tries to find matching pairs of orders and offers. For each detected matching pair X and Y the core component sends  $\{\{X,C\},Y\}$  to the resolver component of the trustworthy party. C is decrypted to obtain the relevant notification profile (type of channel and corresponding end address). Afterwards the resolver requests the notification template from the publishing & rendering server, creates the notification message and dispatches it. The resolver component can add suitable labels to the notification messages to guarantee that they are always identifiable as advertising, which is important because of legal requirements.

There are several cases when it is necessary to change an order X: the user alters attributes of the order, the user wants to suspend or delete an order, or private context parameters have changed. In this case the updated X along with C (which is the same as for the original order) is sent to the MoMa-core-component, which looks up the old order X by its C and replaces respective deletes it.

### **3.3 Matching Component**

For the implementation of the matching server it turned out to be helpful to employ the paradigm of “software agents” (Genesereth, 1994). An agent in this sense of computer science is a software component that resides in a special runtime environment (agent container), has a certain degree of autonomy and intelligence and is able to communicate with other agents by exchanging messages in a certain language.

Each order is represented by an instance of an order agent and may encapsulate rules, e.g. a gastronomy-order shouldn’t match with a “beer garden” when the public context parameter “weather” concerning the current private context parameter “location” is “rainy”. All instances of offers are represented by a single instance of an offer agent. For each type of public context information available there is one agent which can be queried by the other agents. In the case of certain events (updated orders/offers or context parameters, new orders and offers) a short-lived notification agent whose purpose is to communicate the change to the affected agents will be created. If an order agent detects an offer suitable for him he will contact the notification agents, who will initiate the notification process. Orders may be configured to have an expiry date, so order agents can kill themselves.

While there is the concept of mobile agents — agents can move themselves from one instance of the runtime environment or platform to another — for MoMa stationary agents were used. From an architectural point of view it would be preferable to have mobile agents and thus create the agents representing an order or offer on the mobile device respective a server of the advertiser and then move them to the matching platform; but this would require much more resources on the mobile terminals of the end users and each advertiser had to maintain his own agent platform, so we used the stationary agents for the implementation of MoMa.

### **3.4 Business Model**

The basic business model for each form of advertising is that the advertisers have to pay for the presentation of their adverts. This is also the case for the MoMa-approach: the advertisers have to pay for each contact (notification message to an end user) generated by one of their offers. The price for one contact depends on the category of that order and will be in the magnitude of a few Euro-Cents for most categories. For categories covering very costly goods and services (e.g. real estates) or with a lot of competitors higher prices are thinkable. The current implementation assumes the same contact price for a given category for all advertisers; if the number of matching offers for an order is bigger than the number of notification

allowed by that end user we choose the orders to be displayed by random. Another approach would be to allow the advertisers to set a price or bid for a contact and to choose the offers with the highest contact prices.

An additional source of revenue for the MoMa-operator is selling statistical data concerning the pattern of demands, e.g. what kind of product where most often requested by the end users.

In contrast to many conventional method of advertising we do not have to estimate the number of contacts generated like for example for television commercials or newspapers adverts; the advertiser has only to pay for real contacts. There is no requirement to buy a big deal of contacts like for TV commercials, so MoMa-advertising is even affordable for individual enterprises. Also contacts generated by MoMa reach people that explicitly expressed their interest for a certain kind of product or service.

If the end users perceive the offers delivered by MoMa because of their highly personalized nature as valuable information rather than advertisement it is even thinkable that they are willing to pay for the MoMa-service. But in the current implementation they only have to pay the costs for the data transmission when putting an order into the system. Although the prototypes of the MoMa-client-applications use webservice technologies for the communication with the MoMa system and as the usage of a webservice causes a lot of data overhead the data volume for the transmission of one order is less than 1 KByte, so these costs are negligible or will be in the nearer future.

The providers for the public context information (e.g. specialized news agencies for weather or sport events) will be paid by the MoMa-operator. The trustworthy third party could be compensated by the MoMa-operator or could also be a government institution or a non-profit association.

When introducing a system like MoMa there is the well known “chicken-and-egg” of obtaining the necessary critical mass for end users as well as advertisers. End users will only use MoMa if there are enough offers in the system. But advertisers will only put offers into the system if there are enough end users of MoMa. To overcome this vicious circle there is the possibility of automatically obtaining offers from well established eCommerce-platforms without charging the operators of those platforms. Since many eCommerce-platforms offer special interfaces to do this (e.g. webservice interfaces) this can be done without much effort.

### **3.5 Prevention of Ad Fraud**

Ad Fraud is the deliberate usage of an internet advertising system with the aim to impair one or more advertisers of that platform. The most prominent types of ad fraud stem from the payment scheme used: when

applying the “cost per mille” (CPM) schema an ad is shown on a website (e.g. as a “banner”) and the advertiser has to pay a certain amount of money for each time the ad is shown. In the case of the “cost per click” (CPC) scheme the advertiser has only to pay when the user clicks on an ad, see Google (2005) for example. To perform ad fraud a malicious businessman might generate page impression or clicks on adverts of a competitor. Using special software these faked requests can be generated without much effort. For CPC usually a certain budget for one day is defined, so an ad fraud attack can burn up the budget of an advertiser and thus make his ads to disappear (Bomhardt, 2005). There are estimates that 10 percent or even more for particular businesses of clicks are fraudulent (Olsen, 2004) and taking into account that over 40 % of the 9.6 billion US \$ of internet advertising revenues stem from performance based advertising like CPC (IAB, 2005) the effect of ad fraud isn’t negligible.

In the short term the operator of the advertising platform is not impaired by ad fraud because contacts which stem from fraudulent actions also generated revenue. But in the medium or longer term the advertisers will find out that spending money on that advertising platform doesn’t cause the intended effect (in most sales promotion) and thus ask the operator for a refund or stop advertising with that provider at all.

As discussed in chapter 2, mobile advertising can be seen as an advancement of internet advertising and may thus also be vulnerable to ad fraud, especially when the advertisers have to pay for each contact. Since this is the case for the MoMa-system, we also considered different measurements for the prevention of “mobile ad fraud”. Ad fraud for MoMa would mean to sign up for many of the free user accounts and to create orders which fit an offer of the advertiser to be attacked. As we have to assume that the protocol used for the communication between MoMa-client and server is public, an attacker could develop a computer program to automate this.

Since ad fraud is mainly performed by programs or scripts which generate the fraudulent contacts an obvious approach for prevention would be the usage of so called CAPTCHAs. A CAPTCHA is an automated test to tell humans and computers apart by showing a little riddle which at the current state-of-the-art of artificial intelligence can only be solved by humans, e.g. an users sees a picture with distorted text and has to type in that text into an input field (von Ahn et al., 2004). Many providers of web-accounts use CAPTCHAs to prevent the automated registration of multiple account, but for advertising applications you cannot ask the consumer to solve a CAPTCHA before you grant him access to advertising information, especially not on a mobile device with its limited interface where the user should have to make as little as possible data entries.

To secure MoMa against ad fraud it shouldn't be possible to obtain an user-ID without being a human; it might even be necessary to perform some kind of age verification if there are advertising categories with content not suitable for minors. For each ID it is quiet simple to monitor if there is a conspicuous accumulation of orders which match a certain offer and to suspend the account with a given ID or restrict the number of orders for each category. This check has to be performed by the trustworthy party, because the matching-server only sees transaction pseudonyms and thus cannot determine if a set of orders originates from the same user.

#### **4. SUMMARY**

We discussed the features of mobile and wireless advertising as advancement of internet advertising. The introduced MoMa-system is based on the idea of permission marketing to comply with legal requirements and gain user acceptance. MoMa gives consideration to the special needs of a mobile application in several ways: because mobile terminals offer a limited user interface MoMa analyzes private and public context information and employs profiles to expect as little as possible entries from the user. Different notification channels are supported.

Since mobile terminals are very personal communication devices great importance was attached to technical measurements for guaranteeing data protection while also realizing a high degree of personalization. Spam is practical impossible as the advertisers don't have access to the end addresses; if an user doesn't want to receive advertising from MoMa he just has to suspend or delete active orders.

A special feature of the MoMa-context model is the discrimination of public and private context parameters. Unlike for public context parameters (e.g. weather) for the retrieval of private context parameters (e.g. current location of the user) access to the user's mobile terminal is required.

The members from industry of the MoMa-consortium plan to develop a mobile guide for soccer fans based on the results of the project.

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