

TaxiMedia: An Interactive Context-Aware Entertainment and Advertising System

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Abstract: The use of public transport vehicles, such as trams, buses, and taxis as an advertising space is increasing since several years. However mainly the outside of the vehicles is used to show advertisements using paintings, foil or roof-mounted displays. Nowadays, with advances in display technologies, small high-resolution displays can be easily embedded in vehicles and be used for entertainment or advertising purposes. In this paper we introduce an interactive context-aware advertising system designed for cabs, which is targeted to offer context-aware information such as advertisements, points of interest, events, etc. during a cab ride. Additionally it is possible for advertisers to upload their contents and define areas where their advertisements should be shown.

1 Introduction

Since the 1990s, public transportation vehicles have been used as an advertising space. The first example was a Pepsi advertising campaign started in 1993, where the Pepsi logo was painted on urban buses in the Seattle area. This type of advertising is mainly static in that the advertisements do not adapt to their contexts. One of the first approaches towards dynamic advertising content involved mounting electronic displays on cars where the ads could have been updated based on the location, e.g., on taxis in the Boston area. However, all these types of advertising are deployed on the outside of the vehicles. Nowadays small, high-resolution displays are embedded inside busses or trains mainly for advertising, news, or the visualization of location-based information such as details on the current/next train station. In the last few years, also displays in private cars became more common. Such displays are either integrated in the front seat headrests or the central console of the car. These displays are mainly used for entertainment purposes such as watching movies or playing games.

In-car displays are well suited for entertaining the customer by showing him news, information on close points of interest, short videos or even letting him play interactive games. There are already systems commercially available for advertising in taxis such as Tapinto¹, an international taxi-TV supplier, using radio frequency for transferring data.

To explore the potential of in-car displays we implemented the TaxiMedia system, an interactive context-aware system for taxis. Our system is able to show different types of information based on the context of the taxi and can be used to entertain the passengers during the trip. We mainly use our system to visualize location-based advertisements. Those advertisements can be selected based on the location a passenger is picked up at as well as the current location of the taxi, but also further context such as time, weather, or interest of the passenger may be considered.

In the following we show how context information can be used, to more precisely target advertisements to the interests of the user. For example, if a passenger takes a cab from the airport on a week day morning, we may assume that the passenger is currently on a business trip. Hence, advertising hotels in the business district, as well as restaurants, cinemas, or special events in the evening may be interesting for the passenger. In contrast, weekend passengers are more likely to be tourists. Hence advertisements on hotels close to the major tourist sites as well as on interesting upcoming events may be shown. In contrast to available commercial systems, our system is working also offline without any means of connectivity to the server.

The rest of this paper is structured as follows: in chapter 2 we present our concept of a location-based entertainment and advertising system for taxis and how different types of context can be used to enhance the impact of advertisements. In chapter 3 we provide an overview about the architecture of the system and its components. After that we provide a brief overview on related work. Finally we provide a conclusion and talk about future work.

2 Concept

The overall idea as outlined in the previous section suggests itself as a rather simple and intriguing business case. The availability of information about the person looking at an advertisement and the close contact of this person with the digital information can considerably enhance the impact of advertising. In the following, we briefly go into some details about the advantages and requirements for the proposed solution.

2.1 Location

Location is one important type of context for any provision of adapted information. In the event of someone using a taxi, this can be exploited very easily and thoroughly. In contrast to many other settings, three types of location are known at any point in time: the start of the journey, the current location throughout the journey, and the destination.

¹ www.tapinto.info (last access 30.05.2009)

This data can be exploited in various ways:

Starting point: depending on the type of location and the current time and date, some conclusions can already be derived about the purpose and type of customer. Someone arriving at the airport in the evening or being picked up at a business office will most probably be on the way home or looking for a hotel to stay overnight. Someone arriving with a train in the morning can be expected to stay in town most of the day and potentially overnight. This information can be used to present targeted advertisements of, e.g., hotels or theatre tickets.

Current location: the current location during a journey is important to be able to display advertisements that fit a particular region or place that is passed. Targeted advertisements can be shown such as exhibition tickets, offers for sightseeing, or particular events.

Destination: the knowledge of the planned destination of a passenger can be used in a similar way as the knowledge of the initial pick up point. In addition, one can predict that the person will be spending some time at the destination and generate targeted advertisements, e.g. for lunch offers, evening entertainment, and local hotels.

However, also other types of context may be of interest:

Weather: the weather forecast for the destination of the passenger may be used to adjust the advertisements shown on the screen: whereas sunny forecast might result in a suggestion to visit one of the city's nice beer gardens, for rainy weather a restaurant next to a cinema or theatre might be proposed.

Passenger: nowadays, reliable algorithms exist when it comes to sensing gender and age group of a person in front of a display. This information can be used to show gender-specific advertisements as well as to target advertisements towards the most likely age group of the passenger.

2.2 Requirements

The system needs to support the requirements of three main user groups. First, for *advertisers*, an easy and remote opportunity is required to add advertising content and to configure the conditions under which they will be displayed such as the location, time of day, and the frequency. Further it is necessary to agree upon a pricing model and to think about how the impact of the advertisements can be measured (e.g. by providing customers a coupon which they can redeem later in a store). Finally, advertisers need to be provided with feedback about the actual use of the system.

Second, drivers and taxi companies can also benefit from the use of such a system. Whereas it first has to be assured that the hardware can seamlessly be integrated into the car, feedback for the driver as to how customers interact with the system and especially advertisements may be useful. If the driver can also see the currently displayed advertisements, e.g., on a museum, he might be able to provide additional information to the customer. The driver could also use information about the currently displayed advertisement or information on the user interaction (Which advertisements are closed by the user? Which advertisements generate additional queries by the user?) to adjust the route (e.g., if the user wants to buy tickets for a concert at night and the ticket office is just a few meters off the route). However, a business model has to be generated upon which also the driver or taxi company could be compensated.

Third, also the customer has to be taken into account. It has to be assured that advertisements are displayed unobtrusively and that the advertisements generate some added value for the passenger, e.g. by fitting them to the context or by directly providing an opportunity to get more information about the displayed advertisement.

One aspect that is reflected in this list of requirements but only rarely incorporated in realized systems is to give people the opportunity to directly interact with the data on the display. Showing an advertisement about a product to a potential customer is in vain if the person forgets the contents. Providing a direct link to more information or, potentially, even to a shop where the product can be bought can be essential for the success of advertisements. Existing approaches include trying to give the product a catching name or URL, indicating where (in the vicinity) the product can be purchased, or providing a visual barcode that links to the product's web page. The first two solutions are not applicable in the setting within a car. Taking a picture of a visual code and browsing to a web page with a mobile phone is already relatively advanced and has several disadvantages (difficult in moving and less lit vehicles, other passengers are cut off the action, can incur costs for the customer, etc.). We tackle these issues by providing a touch screen that can directly and concurrently be used to display advertisements and let the passenger engage and retrieve appropriate additional information.

In addition to the mentioned features, the proposed infrastructure and concepts can be extended to include further potential in this area.

2.3 Challenges

In the following we present several challenges one might be faced with when deploying such a system.

Appropriateness for specific types of customers: a critical issue is that particular advertisements might be inappropriate for specific customers. This includes problematic cases such as the use of foreign languages, adult contents, and content that is culturally differently interpreted. Other areas such as advertisements focused on male / female customers or elderly people might not be problematic but will reduce the impact if not appropriately displayed. Some aspects can be automatically detected, e.g. the current number of passengers.

Targeting at the particular customer: the concept mentioned in the last paragraph can be brought further to personalized services. People have specific opinions, knowledge and preferences that could be incorporated into the design of targeted advertising. Such information can be automatically derived only with difficulties (e.g. age through image recognition). Two feasible solutions include entering information manually by the driver or the customers themselves or by using personal preferences stored in the customers' mobile phones.

Access to data: in addition to directly accessing additional information as described above, an important fact often neglected in deployed systems is that the retrieved information is lost as soon as one leaves the location (in this case the car). One simple approach (besides having a printer installed locally) would be to push information to the customers' phones.

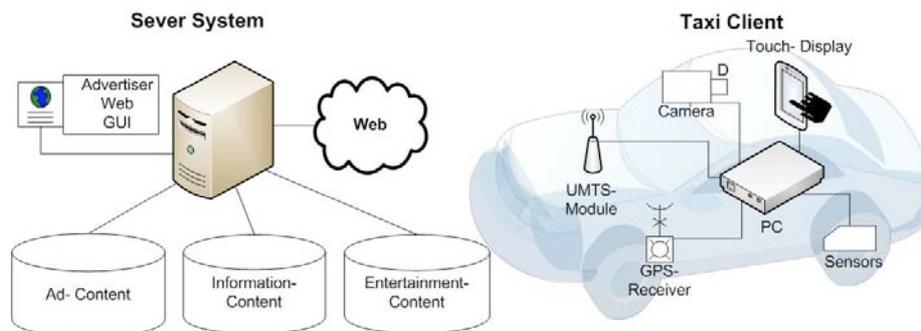


Figure 1: The Taxi Media system architecture.
The system includes two parts: Server System and Taxi Client.

3 System Architecture

The system we implemented includes two parts, the server system and the taxi client shown in . The server system is responsible to manage the information and has a database for the advertisements and other information such as events, news, and points of interest. Additionally we implemented a web-based application which lets advertisers upload their advertisements and define regions where they want their advertisements to be shown.

The second part, the client system, is a Python-based application running on an *Eee PC*² computer that is connected to a touch display embedded into the headrest (see Figure 2). The *Eee PC* has a GPS receiver to track positions and Internet connectivity using a UMTS stick to communicate with the server system. The client system is scheduled to automatically update its contents daily and save all necessary information locally. The update mechanism includes news, advertisements, and entertainment contents. This approach has the advantage that the system does not need any permanent connectivity and works even if the cab is in a tunnel and does not have any coverage. On the other hand the menu layouts of the user interfaces is generated automatically based on the current folder structure and provides the associated content to the customer. That means that if new contents are added to the system later the system can easily update the user interface without requiring any update in the system core. Some contents such as advertisements or hotspots are classified based on the location and shown at the appropriate positions.

Since the display is touchable, the passenger can interact with the user interface. In the idle mode the display shows different location-based advertisements. The passenger can start interacting with the system by touching the display. Then the menus are visualized and the passenger can select the contents. The contents provided are the available hotspots, restaurants and bars, news, and entertainments based on the current location. Additionally other entertainment contents such as games or videos are provided. Further, a small part of the screen is always reserved for advertising while the content is shown. Selecting the advertisements is done based on matching predefined location of each advertisement and the current location.



Figure 2: A touch display is embedded in the headrest.

² <http://eeepc.asus.com/> (last access 30.5.2009)

4 Related Work

Location-based services have been explored in various researches. Kölmel *et. al.* [6] implemented a middleware, which provides a host of functional software modules to enable straight-forward deployment procedures of location-based services. SMMART, explained in [4], is a context-aware application running on smart phones. Ad-me is a context-sensitive advertising system, which aims to deliver more palatable, less intrusive and personalized advertisements integrated with a mobile tourist guide [2]. On the other hand, context-sensitive car advertisements are explored in different researches. Based on the result of a survey reported in [1] more than half of the participants were interested in displaying advertising on their cars. Tester et al presented CommuterNews [8], a prototype aiming at engaging the user into active interaction with an in-car entertainment system.

These researches reveal that context-based advertising is an important aspect, which can be considered for providing more related advertisements in appropriated contexts and cars can be a space for providing location-based information and advertisements. During this project we investigated on how to use vehicles as an advertising space and looked into advertising inside vehicles, especially cabs.

As described in the previous chapter, we use a local folder structure to store and make data available offline. Our approach inspired by the Code and Odyssey Systems [2][6][7] – however we were not able to evaluate performance and scalability of the approach in a real-world environment.

5 Conclusion and Future Work

Nowadays, vehicles are more and more used as advertising spaces. Most of these advertisements are static and only deployed on the outside of the vehicles. However, with new technology being available small high-resolution displays are embedded inside the vehicles and trains. These displays are mostly used for entertainment purposes or advertising. To explore the advantage of these types of display we implemented the TaxiMedia system, an interactive context-aware advertising and entertaining system for cabs. Our system includes a touch display embedded in the headrest and interactive user interfaces. The main purpose of this system is to show location-based information and advertisements. In contrast to other available systems, our system works with a local data basis, which also works without any Internet connectivity. Additionally, the system offers a web-based application for the advertisers to upload their advertisements to the system and to define context such as certain areas where their advertisements should be shown. So the advertisers can easily manage their advertisements.

For our future work, we plan to deploy and evaluate the system in a real environment. We cooperate with a local taxi company, which is interested in setting up the system in one of their vehicles. Hence we could use this high-fidelity prototype as a basis for presentations and further discussion with taxi drivers and advertisers. This would give us further insight as to which ideas are applicable (e.g., that a driver provides additional information or adjusts the route) and which are not. Further, we plan to refine the set of requirements based on qualitative interviews with passengers. We also think of incorporating further sensors such as a video camera into the system setup in order to test additional types of interaction such as a video chat function.

Finally we plan to look into how we can encourage passengers to interact with our system. One option would be to integrate personalized information. Hence data from social networks, friend finders, or web services such as dopplr could be used to show passengers, which colleagues, friends, etc. are in town at the same moment.

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