🏆 *reviewed paper*

RADAR – Potentials for Supporting Urban Development with a Social Geocontent Hub

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1 ABSTRACT

In recent years, a plenitude of mobile services is being developed and used that aim to offer access to relevant information based on a user's location. These services – usually referred to as augmented reality services – allow for new ways to supplement and enhance urban development processes, and they offer new means to exchange knowledge and to foster innovation. Yet, the task of providing information for such services is complex, and there's no uniform contribution process that can be applied for the different tools. Thus, content provision is restricted to only few experts, and knowledge exchange between services is hardly possible at all. These facts hinder an adoption of augmented reality services by a larger user community, and they have a negative impact on the realisation of scenarios aiming to exploit the potentials of augmented reality services. We will present the *RADAR* system that realises an open infrastructure to manage and aggregate arbitrary location-dependent multimedia from different sources like the Social and Semantic Web or digital repositories. It provides an own mobile client for personalised information delivery, but contents can also be used within existing augmented reality services like Layar, Wikitude or ALOQA. Especially in the field of spatial planning, interesting use cases arise. The possibility to make planned future states of the built environment "tangible" right on spot – in the form of images, documents and three-dimensional models – opens up new ways of informing citizens. Also, because of its facilities to easily contribute user generated content, *RADAR* offers a variety of opportunities to foster civic participation.

2 INTRODUCTION

In the course of the rise of mobile devices with more and more functionalities (especially Apple's iPhone and Android-based devices), location-based services constantly grew in popularity [MEEKER ET AL 2009, OPERA 2009]. On the one hand, more and more information is enriched with geodata and thus can not only be presented in a virtual space, but in real, mobile contexts and in a context-sensitive way adapted to the user's preferences. On the other hand, a plenitude of mobile services is being developed and used that aim to offer access to relevant information based on a user's location.

A special kind of such location-based services are augmented reality services that provide a computer-supported, extended reality by displaying relevant information in the user's environment. With the new generation of mobile devices and available „reality browsers", there is for the first time an infrastructure that allows for the creation of augmented reality services without the need of a complex instrumentation and the development of respective interfaces. Thus, the plenitude of localised information can principally be made available to end users in different scenarios by means of augmented reality browsers, depending on the users' locations as well as their preferences and contexts.

Yet, providing contents for these browsers is a difficult task that requires expert knowledge, and the content contribution process is different for each browser.

To conquer these problems, an open ecosystem that allows managing and aggregating arbitrary location-dependent multimedia from different sources like the Social and Semantic Web or digital repositories was developed within the project *RADAR*[1]. The *RADAR* infrastructure allows contributing, managing, and sharing arbitrary geocontents, provides an own mobile client for personalised information delivery, but *RADAR* contents can also be used within existing augmented reality services like Layar[2], Wikitude[3] or ALOQA[4].

[1] see http://www.dfki.de/radar
[2] see http://www.layar.com
[3] see http://www.wikitude.org
[4] see http://aloqa.com

In this paper, we will first give a short overview of existing mobile augmented reality browsers and the core problems related to the respective content creation processes. We then present the RADAR system and its components, before we will present potentials for the use of RADAR in the context of spatial planning processes. A conclusion and an outlook on future work will end the presentation.

3 MOBILE AUGMENTED REALITY SERVICES

We will define mobile augmented reality services as any kind of service that can provide information based on a user's current location and that can be run on a mobile device. In general, we can distinguish two different kinds of mobile augmented reality services: First, there are services that focus on a single and very specific task, e.g., "subway stations in New York". Second, there are services that can provide potentially any kind of information. Such services are usually referred to as augmented reality browsers.

Core problem of current augmented reality services are

The availability of data that can be used within the services – data is prevailing that was especially contributed for the specific browser.

The creation and contribution of data so that it can be used in the services -- the contribution processes are difficult and can even require setting up an own API; furthermore, complex and non-standardised metadata formats and data structures are used.

The heterogeneity of data for augmented reality services – as we have to deal with proprietary data formats, an integration and aggregation of data is either not possible at all or can only hardly be realised.

These factors hinder the adoption of augmented reality services by a larger community, thus preventing their use as a more common tool for a variety of mobile scenarios, also in the field of urban development processes.

Ideally, an augmented reality infrastructure would

- allow any kind of end user – also without specific technical expertise – to provide data for the respective service,
- be able to make use of existing geocontents from a variety of sources such as the Social and Semantic Web as well as digital repositories, and
- offer geocontents in a way that allows making use of them in other services.

4 THE RADAR PROJECT AND SYSTEM

RADAR (Resource Annotation and Delivery for Mobile Augmented Reality Services) was a one-year project initiated in 2010 at the Knowledge Management department of the German Research Center for Artificial Intelligence. The aim was to realise an open and flexible infrastructure that allows users to contribute and manage geocontents, and that fulfils the above mentioned criteria. In the following, we will shortly present the information model used for a geocontent in RADAR, followed by a coarse overview of the system realised within the project, as well as the main features it offers.

4.1 Geocontents in RADAR

On the one hand, the RADAR infrastructure should be able to include very simple representations of geocontents, on the other hand, it should also be possible to use more complex and multidimensional objects. Consequently, to create a geocontent in RADAR, only geocoordinates as well as a title have to be provided. Yet, arbitrary multimedia resources (e.g., text documents, videos, audio files, or even 3D models) can be associated with each geocontent.

4.2 The RADAR infrastructure

The RADAR system is an open infrastructure developed according to Web2.0 design paradigms [O'REILLY 2005]. It realises a social hub for geocontents and allows

- managing, organising, and sharing geocontents,
- publishing geocontents to various mobile augmented reality services,

- accessing and aggregating geocontents from multiple sources like Flickr, Foursquare, Last.fm, LinkedGeoData, Twitter or YouTube, and
- visualising geocontents.

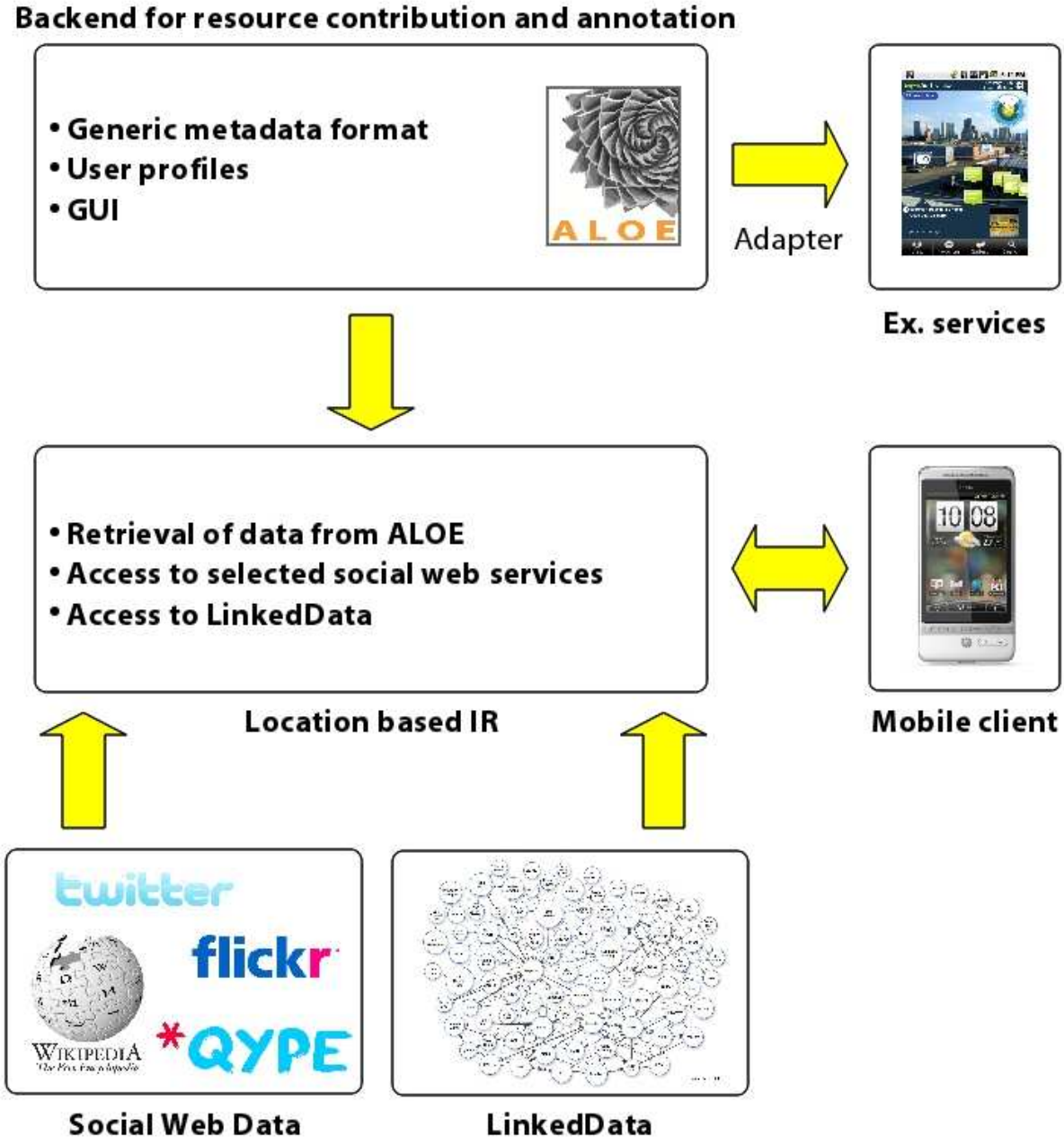

Fig. 1: Overview of main components in the RADAR infrastructure

The RADAR infrastructure consists of the following main components:

- The RADAR Web Interface is an intuitive, web based GUI for comfortable contribution and management of arbitrary geocontents. It is based on DFKI's ALOE[5] infrastructure and offers a plenitude of social media features [MEMMEL, SCHIRRU 2007].
- The RADAR Adapters allow pushing RADAR geocontents to existing augmented reality browsers such as Layar, Wikitude, and Aloqa.
- The RADAR Web Service realises a rich Web Service API and thus allows integrating RADAR contents and functionalities in different contexts and applications.

[5] see http://aloe-project.de

- The RADAR Mobile Client for Android based devices not only offers access to data published within RADAR, but also to a variety of other services that offer location-dependent information. This entails Social Web services such as Flickr, Foursquare, Panoramio, Twitter, YouTube, but also Semantic Web data (via the integration of LinkedGeoData).[6] As the mobile client is also connected to the RADAR user management, users can maintain personal lists of favourites, connect to other users, etc. It also offers means for personalising recommendations and search results.

We will now shortly elaborate on the RADAR Web frontend as well as the RADAR adapters.

4.3 The RADAR Web frontend

The RADAR Web frontend offers access to a variety of means to contribute, share and annotate geocontents. Any content published as "public" in RADAR can also be accessed without registering, whereas it is mandatory to register to contribute any kind of information.

The main features in the Web frontend comprise, among others:

- Simple and intuitive geocontent contribution.
- Upload, share and organise arbitrary types of associated multimedia contents.
- "Social Software" functionalities: tag, rate, and comment on contents; social browsing; contact lists; messaging etc.
- Map search modes with geocontent clustering and support of the W3C geolocation API.
- Interactive map and timeline visualisation of geocontents from RADAR and other services
- Group management for different group types.
- Content search with different filter criteria (filter by mime type, filter by license, filter by date, ...).
- Pushing services (Atom feeds, email reports) for different aspects like new resources or activities on selected contents.
- Embedded player for various content types (e.g., flash, mp3).
- Optional parallel contributions to other platforms (e.g., Delicious, Diigo, Twitter).
- QR code generation for arbitrary contents.

To allow the usage of the system in controlled environments as well as in open and collaborative scenarios, different privacy modes for geocontents can be chosen. Open geocontents allow any registered user to associate multimedia contents, private geocontents can only be enhanced by the owner of the resource, and mode group allows restricting the right to enhance the geocontent to members of one or more groups.

Figure 2 shows a sample screenshot from the RADAR Web frontend in which geocontents for a selected map region were integrated from a variety of external services in an interactive map view as well as a timeline visualisation.

[6] see http://linkedgeodata.org

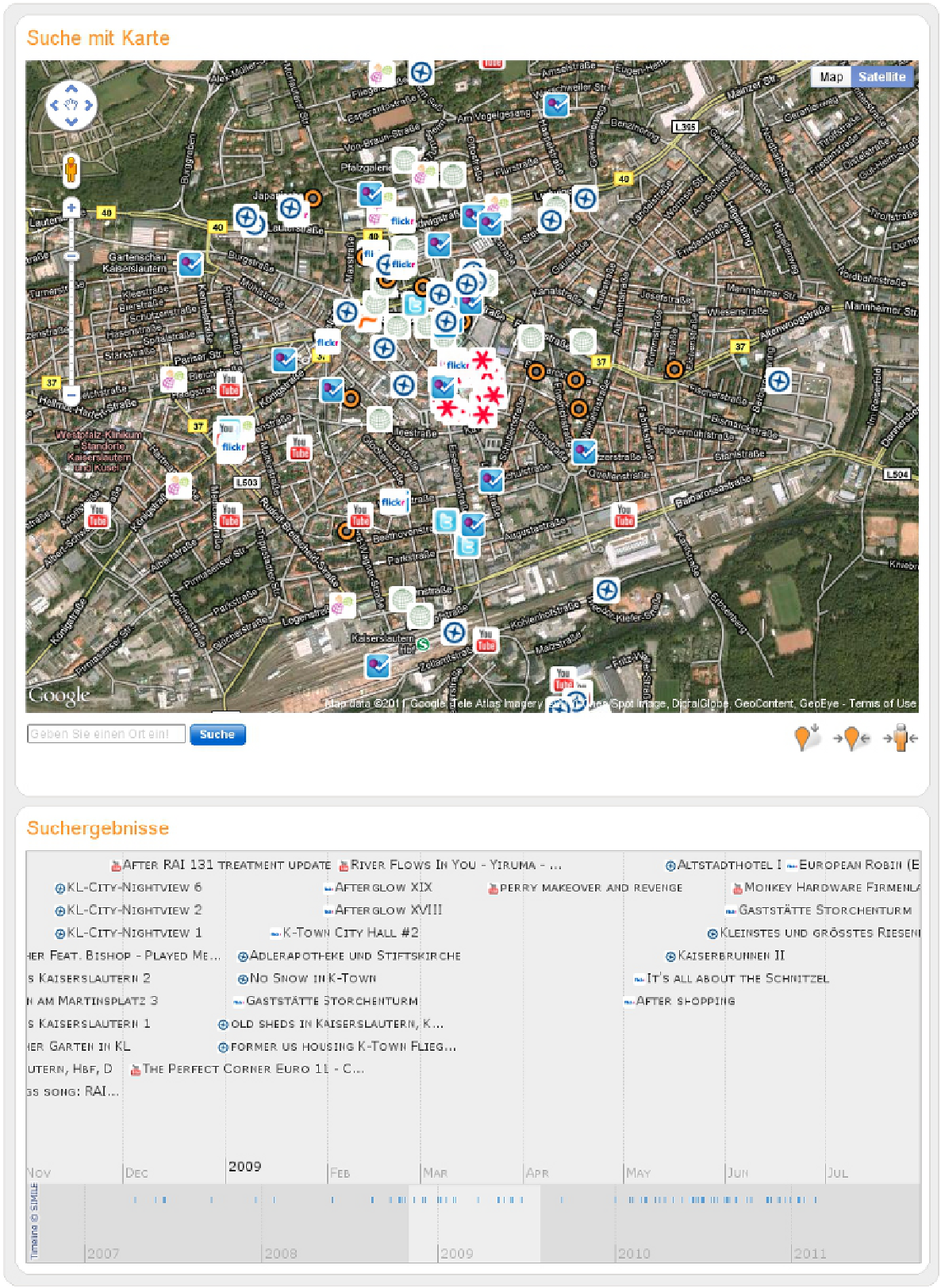

Fig. 2: Screenshot of an interactive timeline visualisation in RADAR with geocontents from different services

4.4 Adapters for existing augmented reality services

To ensure the availability of geodata contributed within RADAR for potentially any mobile device user, adapters were developed for a variety of existing augmented reality browsers. At least one of the services supported by RADAR is available for any popular phone type (this includes Android, Bada, Blackberry, Nokia, Symbian, and Windows Mobile). Thus, basically any owner of a common Smartphone can access the data created within the system.

ISBN: 978-3-9503110-0-6 (CD-ROM); ISBN: 978-3-9503110-1-3 (Print)
Editors: Manfred SCHRENK, Vasily V. POPOVICH, Peter ZEILE

Fig. 3: Sample RADAR geocontents accessed using the Layar Augmented Reality Browser in a map view, list view, and detail view

RADAR does not support each specific feature of the supported services, but instead realises a common set of features supported by all of them. Yet, support was already added for selected scenarios such as the display of three-dimensional objects in Layar and the provision of respective metadata (see Figure 4).

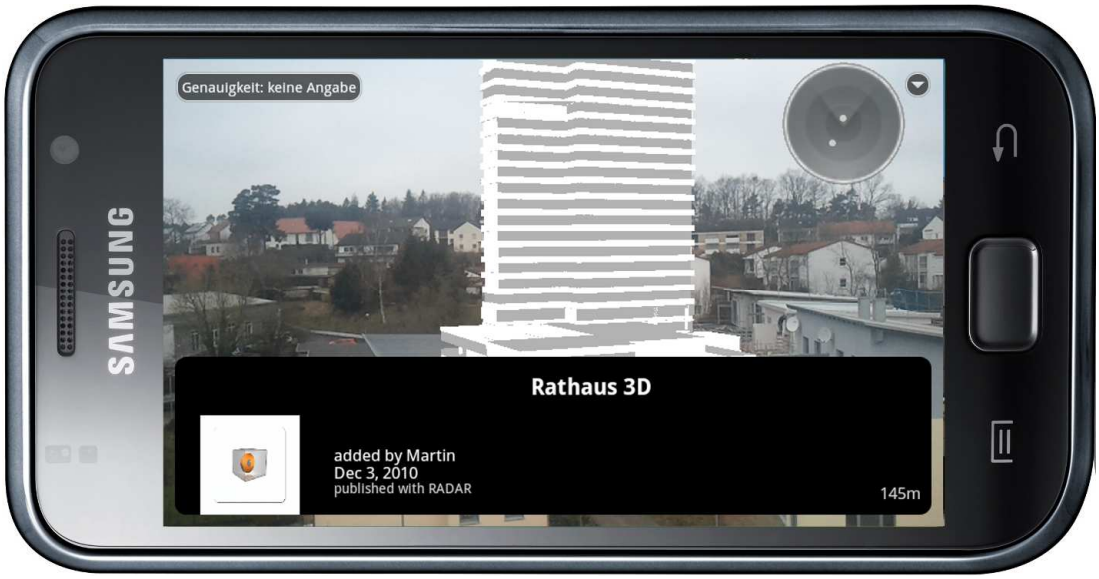

Fig. 4: A sample 3D content published with RADAR and accessed using the Layar service

5 POTENTIALS FOR SUPPORTING URBAN DEVELOPMENT WITH *RADAR*

5.1 Areas of practical application

The practical application of the system is feasible in many areas. A particularly promising area of application is the field of public discussion of urban spatial development processes, especially in the context of an increasingly strong culture of "getting involved" in the planning and realization of projects. This concerns major projects as well as spatially more bounded developments in which citizens actively participate with criticism, but also with their ideas and proposals. These participation processes more and more involve the Internet as a communication medium that allows to easily spread information, and to organize a variety of

activities. Citizens, communities as well as project developers use the Internet to present and discuss ideas and projects. Yet, the exchange of ideas and opinions is thereby usually limited to discussion forums or simple comment functions.

In contrast to conventional websites, *RADAR* provides a plenitude of new functionalities, and has the potential to bring a new quality in online discussions. Because of its ease of use, the large number of possible content types - including 3D objects - as well as its rating and commenting features, *RADAR* can be a modern complement to traditional channels of participation. Furthermore, the accessibility of geocontents via augmented reality services allows exploring future projects in real contexts, even though they are still in the state of planning.

The possibility to interactively visualise digital contents created by end users using different kinds of social services such as Flickr, Twitter, or YouTube also provides a basis for inductive monitoring processes, i.e., people's opinions can be tracked in order to find out about aspects that have to be considered during planning projects, and that would eventually not have been considered in traditional, top-down defined planning processes.

5.2 Augmented City Kaiserslautern – a first use case to explore and evaluate *RADAR* potentials

As a first use case to explore the aforementioned potentials, *RADAR* use cases are currently being prepared in Kaiserslautern. Therefore, a specific *RADAR* instance was set up as a complement to the existing website of the city of. This process is supported by the „Stiftung Gasanstalt" and advised by DFKI, the DFKI spin-off QUERTEX GmbH, and MESS (development and communication of cities and spaces).

Using the platform, existing contents as well as new material will be made tangible – for the citizens themselves, but also for other target groups like tourists. Smartphone-based city tours making use of audio files[7], videos and pictures will therefore be an important component of the scenario.

While tourists may be drawn on *RADAR* by the tourist information of Kaiserslautern and respective advertising material, other means have to be found for the inhabitants of Kaiserslautern to introduce the new offer to them. Therefore, a contest shall be launched, in which people are encouraged to learn about *RADAR* and to actively use it themselves.

The authors have proposed that the issue of this competition could relate to the above mentioned field of spatial development, so that *RADAR* can be tested as a participation-tool for citizen-made urban development. Taking advantage of the potentials of *RADAR*, the competition intends to appeal to citizens to bring in positive ideas to beautify the living environment / townscape. Ideas are searched for how the public space can be improved at specific sites without much effort. *RADAR* would be the platform to contribute, collect, and present these ideas, and also to expose them to the public opinion. Additionally, it offers the opportunity to find allies and supporters.

The sum of ideas becomes visible and tangible on interactive maps offered by *RADAR*, thus, a „map of ideas" is being created, where good ideas with a lot of encouragement can be highlighted respectively. At the end of the contest, the city can support the most popular ideas. Whether the competition will be run as proposed has not been decided yet.

Further scenarios that will be realised are temporary limited use cases in which contents about specific events will be provided to guide visitors.

6 CONCLUSION AND FUTURE WORK

In the future, location-based services have the potential to become an important part in a variety of urban development processes. This concerns the tangible visualisation of projects that are not yet realised, but also the involved communication processes between all stakeholders. The RADAR platform has the potential to serve as a basis to realise these potentials and can thus become a useful tool for different types of urban development and related participation processes. The scenario "Augmented City Kaiserslautern" that is currently being realised will serve as a first example to explore and evaluate the expected benefits of the

[7] As audio files, contents created by tomis GmbH (http://www.tomis.de) are being used that were specifically created for a mobile audio guide in Kaiserslautern.

RADAR platform. Furthermore, contents generated within the European project MACE[8] that also uses ALOE as a social backbone [WOLPERS ET AL 2009, WOLPERS ET AL 2010] shall be made available in several augmented reality browsers using RADAR.

7 ACKNOWLEDGEMENTS

RADAR was funded by the Stiftung Rheinland-Pfalz für Innovation and is based on the social media platform *ALOE* (http://aloe-project.de) developed at DFKI. We like to thank the City of Kaiserslautern for their engagement in the scenario "Augmented City Kaiserslautern", the "Stiftung Gasanstalt" for their intention to support this scenario, and tomis GmbH for their kind agreement to allow the use of tomis audio files.

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[8] see http://www.mace-project.eu