Enabling citizen participation in urban planning by using Augmented Reality

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Abstract
In many German cities, there has been a lack of citizen participation in urban and regional development processes, especially as young citizens are not motivated to get involved. Therefore, an Augmented Reality-App is to be developed as a gamification aspect in order to encourage intrinsic motivation and thus contribute to increased citizen participation. This paper presents the state-of-the-art of the research project Creactive Citizen. As a human-centered design approach, the citizens were integrated into the design process of the AR system to ensure usability based on their user needs. For example, in order to make possible building projects comprehensible for all citizens, the focus is on visualization possibilities through Augmented Reality (AR). To ensure an exchange, voting, comments, and discussions should be made possible. Nevertheless, we have encountered some challenges that need to be further explored concerning the design process and technical AR procedures.

Author Keywords
augmented reality, citizen participation, urban planning, hci

CCS Concepts
+Human-centered computing → Mixed / augmented reality;
Introduction

The research project Creactive Citizen aims to digitize the process of citizen participation in infrastructure and urban development projects and thus to better address citizens. In the context of urban and regional development, there is an increased interest of citizens in participation. Citizens like to see more opportunities for participation on the web, but the opportunities are partially not existent or not known. Participation in public planning procedures is partly available, but it does not reach many or costs too much effort. Traditional participation procedures are currently offline events such as citizens’ meetings, which are usually attended by the same people as always and predominantly involve the older generation. Our results show that mainly young people are not yet addressed and motivated to participate in civic participation processes, although they are particularly affected by urban development projects like urban restructuring. A digital system is intended to remedy this situation by allowing people to contribute their suggestions, ideas, and criticism. By using a digital system, every voice should be heard and taken equally seriously - regardless of the age or other characteristics of the persons. This paper presents the state of the art of our research project. The aim is to develop a mobile participation app for citizens in order to support citizen participation in the context of urban and regional development projects (e.g., new building construction, design, and revitalization of public spaces). For example, to visualize construction work or changes in public space, innovative approaches such as augmented reality are to be used. In this way concrete ideas and conceptions are more tangible and comprehensible. Thus, the real environment can be modified into a new design, so that it is visible what the environment might look like in the future. Additionally, discussions and comments, as well as voting or entries in maps are used. Citizens will be able to use the system to inform themselves, exchange information, and give an opinion or preference. Until now, AR has always been used individually in many other systems. Since this is about citizen participation and, therefore, communication and collaboration, the AR system will be used to generate ideas and ensure an exchange of ideas.

Project details

Creactive Citizen is a EU-funded research project and has a term of 3 years, which ends in March 2021. The working group consists of political scientists, computer scientists (field of HCI and CSCW) and a software development company. Besides, a german city (with 25,000 citizen) is involved as a project partner and provides concrete problem scenarios. For instance, the system will be used for a citizens’ vote on designs for a new town hall.

Approaches and Challenges

First, a practice and information analysis were carried out, in which theory-based research results, as well as actual practical experiences of municipalities, were collected, compared, and evaluated. Surveys with 96 participants as well as 19 interviews were conducted with politicians, administrative staff, and citizens to identify the current participation. As a part of a user-centered design approach, users were involved at an early stage to identify user needs in direct exchange with them (see [4]). As a step towards the desired citizen participation, various activities were held in our partner city to gather the ideas of the citizens regarding urban development. There were activities like citizens’ meeting, walks with the citizens, a thematic working group and a website for collecting ideas. These activities result in different citizen inputs and are summarized in various documents, which were used as a basis for information analysis to identify further needs. Methodologically, the individual statements were semantically analyzed and categorized using an affinity diagram. From the analysis of the citizen
input, it can be stated that different types of ideas are relevant. On the one hand, the ideas were described in a very abstract way, but on the other hand, there are very concrete ideas such as ideas for structural measures: “In the design of the waterfront, footpaths and cycle paths, as well as new buildings with common architecture, should be considered.” Such ideas strive for the possibility of visualization.

**Focus on young citizen**
As the project progresses, the focus was placed primarily on young people, as they have been the least involved and should be addressed more as an underrepresented group. For this reason, a group discussion with a youth parliament was organized, in which mainly discussions on topics such as leisure time and relation to the city, engagement, and participation, as well as the use of digital and analog media, were questioned. It became apparent that citizens like to communicate and collaborate and like to work together on possible ideas for improvement. Therefore, this interaction should be supported by the AR system. Also essential are requirements such as voting, discussions, comments. An exchange among citizens (including city officials) should be made possible to obtain a broad overview and to involve many citizens. Further work with the youth parliament was pursued by conducting a Design Sprint Workshop based on the findings of the group discussion. This included the phases **Understand, Ideation, and Prototype**. In the first phase it was discussed how young people currently interact with each other by creating new ideas. Based on this, they developed design ideas for an AR system, which supports their interaction. For the transformation into concrete design solutions, the participants used mockups, storyboards, and Lego prototypes.

**AR Prototypes**
A prototype was iteratively implemented, with which it is ultimately possible to map two different designs to an existing building (see figure 1). The view can be designed vertically or horizontally. It is possible to add comments at any point on the digital object so that different user can comment on the designs, and an exchange can be supported as collaboration. For example, an opinion on the selected door can be described and will be made visible for others. This promotes the collaborative development of ideas. Technically, the implementation in Unity3D took place using the Vuforia framework. The natural feature tracking provided by Vuforia is used to determine the markers. Real-world objects are used to form the markers (see [5]).

![Figure 1: Screenshot of a new building design in AR](image)

Besides we developed other ideas like providing digital objects (e.g. benches, trash cans). The objects are given by the system and are available to citizens for redesigning the city (like individual squares, parks). If a citizen has designed the environment from a certain point of view, the AR system should make it possible for someone else to take her/his perspective and, if necessary, modify her/his design further. This collaborative development and advancement of
own or third-party ideas leads to a gamification-approach, which results in an increased motivation to use.

**Design- and technical challenges**

There are some challenges in the design process and in the technical implementation of AR systems. Already the authors [3] identified technical and design challenges in developing AR applications. As we had difficulties in finding a suitable design approach for the AR system, the design process is challenging. Individual methods and tools, especially in the field of AR, still seem to be a gap. Also, the authors [1] point out that universal design principles are usually too generic and cannot be meaningfully mapped to AR systems in a way that an added value would result. In contrast to the design of other (mobile) systems, the real environment and the real context has an enormous importance in AR, which has to be considered. In our workshops, we used tools like Lego or transparent foils, which are attached to windows or pictures of real environments, to design mockups and prototypes considering the environment and the context. Also there are technical challenges regarding the use of AR in free spaces. A distinction is made between two tracking methods: The geolocalized technique and the marker-based technique (see [2]). Markers are used when areas with fixed buildings or infrastructure are being redesigned. In the case of free spaces without fixed infrastructure, however, this method turns out to be difficult because there are no reference points for possible markers. Although the geolocalized approach could be used, the use of GPS is still entirely inaccurate and could lead to unsatisfactory results in the representation of AR. A suitable approach is to be further researched.

**Conclusion**

After preliminary research, the focus was placed on young citizen, as they are especially underrepresented and un-addressed to get involved in civic participation processes. A user analysis showed that the visualization of ideas and an exchange of ideas among citizens and with city officials is essential. A mobile AR application will be developed to visualize ideas and drafts and offer possibilities for voting, commenting, and discussion. This should trigger the intrinsic motivation like gamification, so that more citizens are motivated to use the app and thus become involved in citizen participation processes. In contrast to previous AR apps, the use of Augmented Reality should encourage collaborative use and exchange instead of individual users. AR can make a significant contribution to a new form of participation and involve and motivate more citizens. Nevertheless, our project presents some challenges regarding the design process for AR systems as well as technical limitations, that need to be researched further. There is a lack of orientation towards existing and standardized guidelines or methods that are specifically designed for AR and considers the spatial context. Besides, different technical approaches to AR need to be considered depending on the use case in detailed urban planning.

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**REFERENCES**


