
Using Social Media and Web GIS Application for Geodesign Purposes – A Case Study in the City of Bernburg, Germany

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Abstract

This paper presents an approach demonstrating a social-media-embedded GIS visualization platform for bringing citizens to landscape planning online as a community's participation medium. This case study was performed in a virtual space representing Bernburg, Saxony Anhalt in Germany, prepared in mid-2014 and online participation took place from November 2014 to January 2015. With the official data set provided by the state surveying authority of Saxony Anhalt, an online 3D virtual city model¹ was built with a data manipulation process and add-on communication features.

In the first step of this project, as a pilot program, students from Anhalt University and other universities were invited to the program and asked to visit the online 3D virtual site via a Facebook page. They were asked to explore the virtual space and leave comments on the spot where they were interested in within the planning site. Subsequently, a survey was conducted for the participants and examined the usability of the application and the built-on features.

This case study illustrates the first-time assessment of the presentation and participation application using social media and web GIS application for Geodesign purpose and will be the foundation for further research.

1 Introduction

Public participation in the early stage of the landscape planning procedure is a large issue, drawing social interest and concern in regional development projects, One example is the Stuttgart 21² case in 2007, which is still controversial today in the year 2014. People want to be listened to about how their surroundings will look like in the future, and want to be involved in the planning procedure when it comes to their daily lives and environment. As a Geodesign purpose, a variety of participation methods or medium have been proposed and developed from traditional processes such as town meetings and workshops to not only web-based informative and communicative boards, but also high-tech demanding digital

¹ The technical solutions that enables 3D City modeling integrated with social media is supported by VirtualcitySYSTEMS Inc.(<http://virtualcitysystems.de>) and Agency9 Inc.(<http://agency9.com>).

² StuttgarterZeitung.de (<http://www.stuttgarter-zeitung.de/stuttgart21>) shows the current status of the sharp debating regarding the railway station developing planning.

visualization techniques (SCHMIDT et al. 2010a and b). In addition to the up-to-date technology based visualization tools for helping people understand better, web based social media are proposed as planning and design participation tools. Renée DE WAAL et al. (2013) explored an application of social media in a landscape design and proposed that social media need to be considered as a means of participation.

Accompanying social media, a variety of researchers have discovered that visualization plays a role in participation during discussions and providing background information and current issues and comparisons such as before and after (WARREN-KRETZSCHMAR & TIEDTKE 2005). However, it is controversial as to how realistic the virtual 3D needs to be, since building a photorealistic virtual 3D modelling requires a lot of time and creates budget issues. Therefore, methods and communication tools must be developed to enable collaboration and to improve communication in a two way communication (STEINITZ 2012, SCHMIDT et al. 2010a/b, PIETSCH 2014).

In this case study, a simplified modelling is applied, and visual features, applications and social media are demonstrated. And, it is assessed whether the applications are usable as a means of online participation for Geodesign purposes.

2 Data Manipulation and Presentation for the Participation Process

2.1 Data Manipulation

The official raw datasets supported by the state surveying authority of Saxony Anhalt, contains 1) Digital Terrain Model (DTM), 2) 3D models (buildings) and 3) aerial images. The data were manipulated to 3D CityGML by FME (Feature Manipulation Engine: www.safe.com/fme) software in an automatic processing and transferred to CityPlanner (cityplanner-online.com) web server in VirtualcitySYSTEMS.

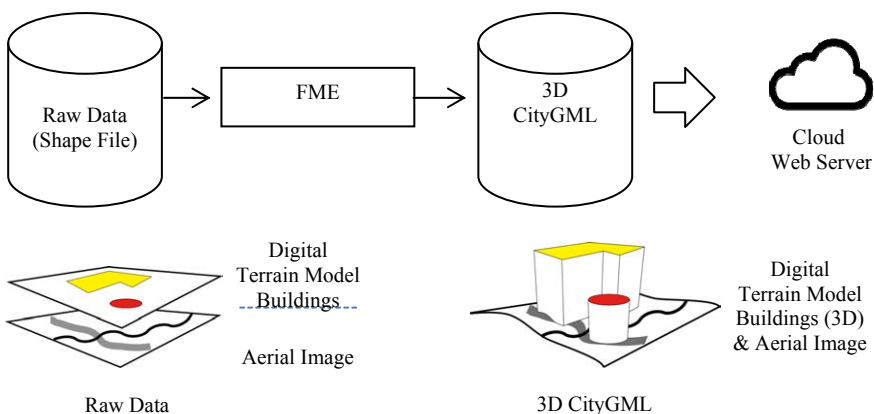


Fig. 1: Data manipulation process into 3D City GML and transferring to a cloud web server

2.2 Presentation for the Participation Process

CityPlanner is a web based commercial GIS service and provides an active communication environment in which projects can be created, opened instantly, manipulated and added with commonly used 3D modelling applications, such as SketchUp or Autodesk 3D studio Max, by project members. Additionally, it is engaged with social networking services like Facebook, Twitter and Google where participants can add and share their ideas or comments on Geo-referenced points. It has been proven that interactive function engaged with visualization helps users not only understand the surroundings, but also brings citizens' interest and the credibility of the visualization (WARREN-KRETZSCHMAR 2011).

In addition to the 3D models (buildings) with LOD1 (Level of Detail 1) created by an automated process (Fig. 2), a few detailed elements indicating orientation as well as landmarks that help participants to picture the planning situation (KRETZSCHMAR 2012) were added (Fig. 3). The detailed models were downloaded from Google warehouse and they are free for use for non-commercial purposes. Also, the names of main streets (Fig. 4) were shown as 3D on the virtual space and landscape design proposal (Fig. 5) is illustrated on the planning site.

Besides, the additional information (Fig. 6) such as the history of the architecture, the current pictures and videos were provided on the virtual site. Finally, the CityPlanner for Bernburg is set up with an introduction and explanation on the right (Fig. 7).



Fig. 2: Buildings (LOD1)
(© GeoBasis-DE/
LVermGeo LSA)



Fig. 3: Landmarks
(© GeoBasis-DE/
LVermGeo LSA)



Fig. 4: 3D street name
(© GeoBasis-DE/
LVermGeo LSA)

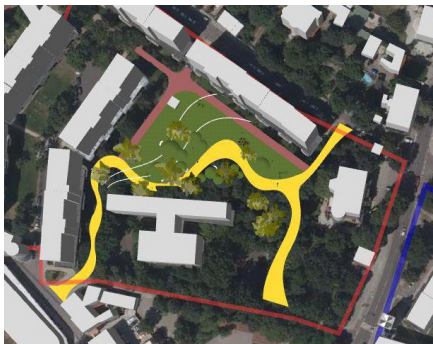


Fig. 5: Landscape design proposal
(© GeoBasis-DE/LVermGeo LSA)

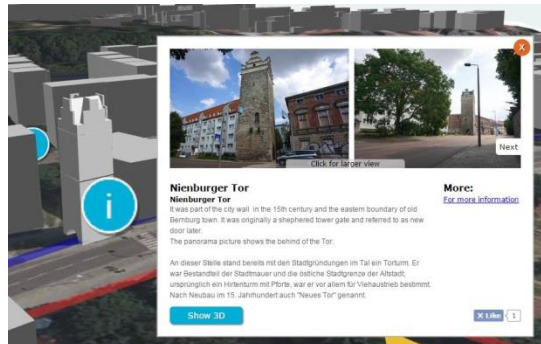


Fig. 6: Additional information
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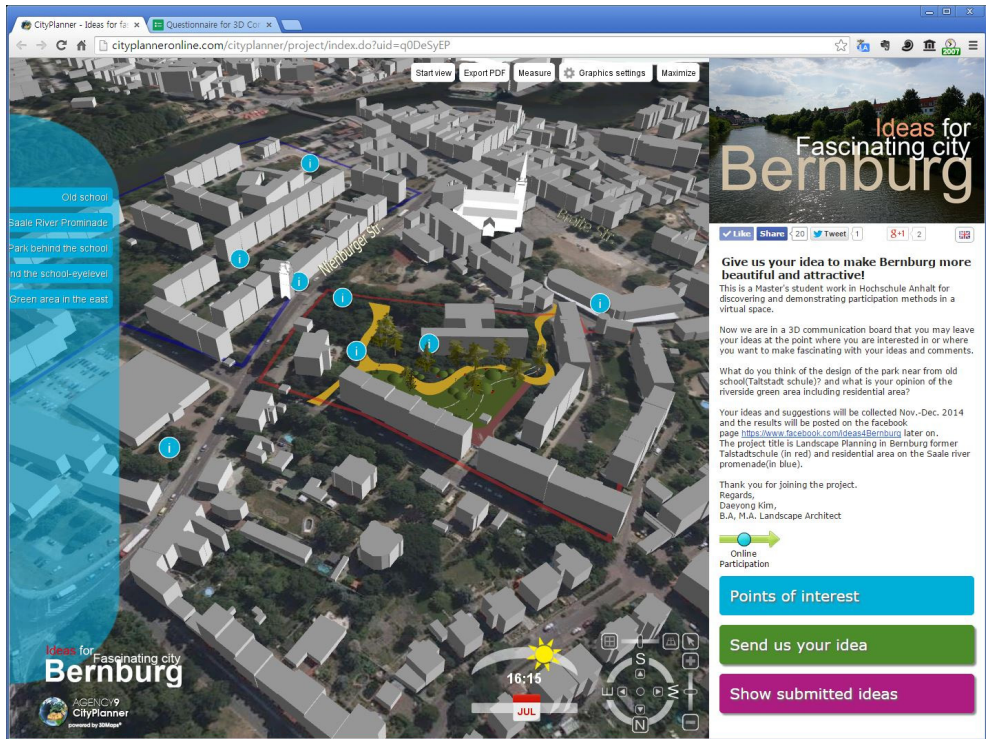


Fig. 7: CityPlanner for Bernburg web page: integrated with visualization, information and social networking (© GeoBasis-DE/LVermGeo LSA)

2.3 Participation and Social Networking

The CityPlanner for Bernburg and Facebook page named ‘Ideas for Fascinating City Bernburg’ were opened at the same time and the pilot program for participation was begun at the end of November 2014 for a limited number of people who mostly consisted of the students of Anhalt University, and other university students. The Facebook page (Fig. 8) was expected to play a role as a portal site providing a direct link to CityPlanner for Bernburg (facebook.com/ideas4Bernburg) and supplementary information.

One of the main features of this project is social networking implementation which makes citizen’s participation accessible online and enables instant feedback from/ to other participants. Also, this procedure is expected to go viral (KANTER & FINE 2010). When participants leave comments on the place of interest with icons, other participants can see the comments and share them on their personal social networking page or express ‘like’ on Facebook as a means of ‘agree’ (Fig. 9). The comments on the CityPlanner can be collected and exported as Microsoft Excel, Adobe PDF and ESRI Shape File format with coordinate information (Fig. 10).



Fig. 8: Facebook page



Fig. 9: Comments and link to social networking
(© GeoBasis-DE/L.VermGeo LSA)

| Name | Category | Date | Comment | Coordinate east-west | Coordinate north-south | Agrees | Likes |
|--------------------|----------------|--------------|---|----------------------|------------------------|--------|-------|
| Salar Jamshidi | Activities | December 21 | Roof garden, with different functions (maybe some | 688649.9339 | 5742435.042 | 1 | 1 |
| Toomaj Goudarzania | Activities | December 1, | lots of people are living here because of the apartm | 688699.8207 | 5742459.085 | 3 | 1 |
| Toomaj Goudarzania | Favorite Place | November 30, | I think this sport complex can have a welcoming de | 688824.8381 | 5742529.963 | 2 | 2 |
| Salar Jamshidi | Favorite Place | December 21 | It can be a student dorm with a Library and Mensa | 688652.8339 | 5742418.691 | 1 | 1 |
| Toomaj Goudarzania | Living | December 1, | This place is a place for residences and from the ad | 688595.2211 | 5742496.043 | 2 | 1 |
| Salar jamshidi | Nature & Parks | December 21 | I like this green areas around this residential buildin | 688886.1451 | 5742401.008 | 1 | 1 |
| Hyun Kyung Park | Other | November 25, | I'd like to have some smart grid housing area. We m | 688625.2735 | 5742502.563 | 1 | 1 |
| Saad Mujahid | Other | December 21 | I like the area, big green with good path, in my opin | 688654.9889 | 5742482.761 | 1 | 1 |
| Chen Ling | Other | December 7, | How about here, it might be also merged in the site | 689057.7977 | 5742498.077 | 4 | 3 |
| Saad Mujahid | Other | December 21 | No light in the area, during night or after 8:00 PM th | 688807.074 | 5742357.828 | 1 | 1 |
| Claire | Other | December 21 | I would like to make this area designed for a rest. S | 688963.6382 | 5742339.957 | 1 | 1 |
| Ryan An | Service | December 21 | If some leisure activity areas are created near rivers | 688774.2926 | 5742203.821 | 1 | 1 |
| ... | ... | ... | ... | ... | ... | ... | ... |

Fig. 10: Comments and coordinates extracted from CityPlanner (example)

3 Survey

A survey was conveyed with four categories: tools for navigation and viewpoints, presentation methods, orientation and social media implementation and usability of CityPlanner. The answers were collected from 19 respondents online and off-line. The number of the survey responses was insufficient to make valid statistics, however, the participants' answers from the questionnaire are still meaningful in terms of this pilot project.

Subsequently, System Usability Scale (SUS)³ was applied in order to make a general assessment of the CityPlanner. Each question is rated on a five-point-scale with anchors from 'Strongly Disagree' to 'Strongly Agree' with Likert Scale (MCLELLAN 2012). To calculate the SUS score, for odd numbers, minus one was added from the response from one to five scale position and, for even numbers, five minus the scale position was applied. The overall value of System Usability Scale is obtained by multiplying the sum of the scores by 2.5

³ The System Usability Scale (SUS) was developed by John Brooke in the 1980s as a "quick-and-dirty" subjective measure of system usability. It is widely used, simple and scientifically validated questionnaire tool (MCLELLAN 2012).

(BROOKE 1996). Some of the words in each question were modified from the original Brooke's questionnaire set, to make questions suit this project (Fig. 11).

1. I would like to visit this Virtual 3D website frequently.
2. I found that this Virtual 3D website is unnecessarily complex.
3. I think this Virtual 3D website is easy to use.
4. I would need the support of a technical person to be able to use this Virtual 3D website.
5. I found the various functions in the Virtual 3D website were well adapted (joined/integrated).
6. I thought that there was too much confusion in this Virtual 3D website.
7. I think that most people would learn 'how to use this Virtual 3D website' quickly.
8. I found the Virtual 3D website is very uncomfortable to manage.
9. I feel very confident using this Virtual 3D website
10. I need to learn a lot about this Virtual 3D website before I could effectively use it.

Fig. 11: Modified System Usability Scale (SUS) Questionnaire

4 Results

The following is part of the first results from the questionnaire (N=19).

| | | Very much | Some- what | Neither | Some- what | Very much | |
|--|---------|--------------|---------------|----------|---------------|--------------|-------------|
| Q. What do you think of the navigation and viewpoint tool? | Boring | - | 3 | 1 | 10 | 5 | Interesting |
| | Complex | 2 | 3 | 2 | 9 | 3 | Simple |
| | Useless | - | 1 | 1 | 9 | 8 | Useful |
| Q. What do you think of the white 3D-box-like buildings? | Boring | - | 1 | 3 | 3 | 12 | Interesting |
| | Complex | - | 2 | 2 | 7 | 8 | Simple |
| | Useless | - | - | 1 | 7 | 11 | Useful |
| Q. What do you think of the design suggestion in the participation step? | Boring | - | 1 | 2 | 7 | 9 | Interesting |
| | Useless | - | - | 2 | 11 | 6 | Useful |
| Q. What do you think of the orientation elements (church and street name) to indicate where you are? | Boring | - | 3 | 4 | 7 | 5 | Interesting |
| | Complex | - | 2 | 5 | 3 | 9 | Simple |
| | Useless | - | 1 | 3 | 9 | 6 | Useful |
| Q. What do you think of the connecting to social networking? | Boring | - | 1 | 1 | 5 | 12 | Interesting |
| | Complex | - | - | 4 | 7 | 8 | Simple |
| | Useless | - | 2 | 2 | 3 | 12 | Useful |

Fig. 12: First results of the questionnaire

The System Usability was evaluated, based on the formulas by McLellan "each score ranges from 0 to 100 and it stands for: 0-64 Not Acceptable, 65-84 Acceptable, 85-100 Excellent" (MCLELLAN 2012). In the survey result, 3 responses indicate below 65, 12 responses range from 65-84 and 4 responses are above 85. The average score from 19 responses is 73, located in the 'acceptable' range (65-84), meaning that the system is 'acceptably usable'.

85-100 (Excellent) : 4 responses
 65-84 (Acceptable) : 12 responses
 0-64 (Not Acceptable) : 3 responses

5 Conclusion

This case study demonstrated 1) time and cost efficiency of the base modelling and building the platform, 2) people's participation without time and space restrictions and 3) social media embedded in 3D space as one of the visualized communication solution tools.

It gives a clue that the 3D Visualization method with simplified model level (LOD1) is enough for participants to illustrate the city settlement and the surroundings, on condition that there are proper distinguishable add-on elements as orientation function. Based on the orientation elements, participants could notice where they are navigating on the virtual space. Moreover, it is proved that LOD1 modelling is efficient not only for landscape planners to build up a virtual 3D environment on the web quickly, but also for the participants to load the lightweight model data and explore the virtual 3D space without high-tech system requirements.

In addition, Social Networking was evaluated as a well applied function with Virtual 3D space and it was mentioned by the pilot program participants, e.g. "It is like you've connected the seller and buyer together in easier way." and "It is a very easy way to absorb and help people join and have a discussion about the future city." It is also said that the design suggestion was interesting for involving people.

However, it was reported that there were technical problems with Java (www.java.com) plug-in installation when CityPlanner was being loaded. One is that the Java file size is too big (28.3MB-88.3MB, depending on the computer operating system), which made users wait for a long time not only for downloading, but also for the installation. The other is that a security-related allowance must be accepted by users when the internet browser accesses the project site. The two technical matters frequently made participants frustrated and they ended up giving up joining the program. It is, therefore, required to find a solution to make it convenient for participants to access the project site without technical difficulties.

This case study demonstrated that this 3D virtual space implemented with social networking has a high potential for making participation more efficient and more effective in Geodesign processes, even though the pilot project is open to a limited number of participants. At this time, this participation method might be applied as a supplementary function, but it is expected that collaboration and communication in the planning process may be improved in the future (STEINITZ 2012, SCHMIDT et al.2010a and b). Presumably, these tools will be more adaptable to the young generation and enable them to draw more attention to the development for their surroundings, giving their thoughts and ideas on the plan an easier way without the restrictions in time and space.

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