# PlanYourPlace: Merging Social Networks and Participatory GIS for Participatory Planning

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**Key words**: participatory GIS, citizen participation, urban planning, online platform

## SUMMARY

The planning and execution of urban development projects should involve citizen participation. Citizen participation is essential if the needs of the population are to be addressed when undertaking public development projects, and participation is essential if private construction projects are to be accepted by the residents that live adjacent to and within such projects. As a new — complementary — form of citizen engagement the planning and participatory Geographic Information Systems (GIS) literature proposes the use of Web 2.0 technologies to facilitate engagement with a broader range of citizens. The PlanYourPlace project was established to develop such a participatory planning platform for communities within and surrounding the City of Calgary. In particular the platform should enable citizens to voice their opinions, and facilitate discussion of urban development scenarios between citizenry, city planners, and decision makers. Social networks provide functions that allow participants to inform, discuss, vote and share, whereas GIS provides functions for creating plans and performing impact assessments. Hence, the proposed planning platform merges social networking with GIS. In this article we outline what functionality the participatory planning platform should provide, and discuss constraints that emerge when considering the platform user, the intended user activities, the context of use, and access to data. We will then present a technical architecture for the web platform that can address these constraints. Subsequently we report on the current state of implementation and outline challenges for future work.

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## 1. INTRODUCTION

The advent of social networks, such as Facebook.com, Google+, and renren.com, has changed the way that people communicate, particularly in countries with high Internet uptake (Ellison et al. 2007, Pew 2011). It also has the potential to shape (urban) planning in the near future. In particular the requirement for public participation in planning processes could benefit from the engagement of people via social networks. Researchers in Participatory GIS (PGIS) have for some time developed and explored web-based approaches to public participation (see Kingston et al. 2000, Rinner et al. 2008, Bugs et al. 2009). However, the agencies that want to, or are legislated to collect and consider public opinion as part of their decision making process have rarely adopted, let alone implemented, participatory web-based GIS — probably due to the investments that must be made (Mandarano et al. 2010, Foth et al. 2008, Hunter et al. 2011). In addition, agencies and citizens do not seem to be aware of the possibilities that social networks can provide for participation in planning — despite the fact that political activists have adopted social networks to promote their cause (www.facebook.com/OccupyWallS), or that police have adopted social networks to aid crime investigation (Diehl 2011). Probably the most successful type of citizen-agency Web 2.0 engagement strategy recently, with a spatial focus, has been initiatives such as Ushahidi.com, a participatory crisis information platform, and fixmystreet.com.

The PlanYourPlace (PYP) project was founded to develop a participatory planning platform that could aid the development of community plans within and surrounding the City of Calgary, Canada. In particular, the web-based platform should inform and educate community members about development options, and support their participation in the planning process. Important principles for platform design were that the system should focus on social and collaborative perspectives, and that the system should adopt a grass root planning perspective first, rather than a technology-centred perspective. Hence, choosing a social network-based approach for the underlying software architecture was a logical step. However, the use of social networks for participatory planning requires adaptation of social networking software. Whereas social networks provide functions for informing others, and for commenting and voting on content (e.g. articles, comments and images), they do not offer functions for the display or evaluation of development plans. Nor does there exist (accessible) tools for managing citizen feedback via rankings or comments. This paper addresses the functions that the PlanYourPlace team will develop, and presents the technical architecture for a social network-based planning platform.

To identify what functionality is required, and what is desirable for a participatory planning platform we undertook a literature review, which is presented in the next section. We then outline design considerations that emerge from the intended usership, i.e. community residents, planners, and decision makers, and technical issues (refer to Section 3.2 below). An architecture that embodies these conditions is then presented for the PlanYourPlace platform. Finally we comment on the current state of platform implementation, and discuss a

series of challenges for future research and development.

## 2. REQUIREMENTS FOR PARTICIPATORY PLANNING

As outlined in Rubin and Chisnell (2008) the first step in a user-centred design processes is to perform a needs analysis to explore what functionality is useful for future software/platform users. Hence, we undertook an analysis of the planning and participatory GIS literature to establish a list of functions that are required for participation, as well as functions that would enhance participation. The results of the review are documented in a project report (Hunter et al. 2011), and summarized here.

When considering Smyth's (2001) ladder of e-participation, which is somewhat similar to Arnstein's (1969) ladder of participation, the lowest level of participation, online service delivery, is to inform the citizen. For planning this can take the form of plans, maps, documents, images etc. However, as Talen (2000) and Drummond and French (2008) note, information should not flow in one direction only — from planning departments to citizens — but should flow two ways to allow citizens to express their desires for their community. Providing community residents the ability to discuss planning projects with city planners, and with others from their community elevates participation to the second rung of Smyth's e-participation ladder, online discussion. Such functionality was proposed by Guhathakurta (1999) and Drummond and French (2008), among others, and was implemented in participatory GIS platforms by Zhao and Coleman (2006), Rinner et al. (2008) and Hall et al. (2010). The next step on the ladder of e-participation adds online survey capabilities that allow users to rank (e.g. sorting alternatives), rate (e.g. 1-5 stars), or vote (e.g. like or dislike) on alternative planning options. Carver et al. (2001) and Voss et al. (2004), for instance, implemented participatory GIS applications that provided ranking functionality.

Up to this point we have outlined three functions that progressively improve citizen participation for planning, and aid communication between citizens, city planners, and decision makers: (1) providing information (i.e. content), (2) allowing discussions, and (3) enabling ranking, rating, and voting on content. We deem these functions to be required for any online participatory platform, and note that these capabilities are commonly found in social networks such as Facebook and Google+. Researchers (Carver et al. 2001, Voss et al. 2004) have also implemented functions one and two in participatory online GIS.

The ultimate level of e-participation, as defined by Smyth (2001), is online decision support systems. This level of citizen participation in planning can be achieved with functionality that cannot be found in social networks (yet). Peng (2001) and Drummond and French (2008) propose tools for the evaluation of planning alternatives. Such evaluations could be performed by calculation of indices that describe effects on demographics, transit use, resource and energy consumption, or even fiscal impacts for a community or city. In Hunter et al. (2011), we outline types of decision support, or evaluation models to be implemented as part of the PlanYourPlace project. This higher level of participation in planning can also be achieved by developing tools that allow people to modify plans, or sketch completely new alternatives (Peng 2001, Drummond and French, 2008). To encourage discussion, this functionality requires that these alternative (new) plans be shared with city planners and other citizens.

The provision of development plans in the form of two-dimensional (2D) map-like

representations can be considered part of the "information provision" functions. However, a community resident's experience of "what things may look like" is likely to be improved when three-dimensional (3D) views and animations are presented (Sheppard and Cizek 2009, Pettit et al. 2011). Consequently, 3D views may help reach decisions for or against a project faster, and may help select between different planning alternatives. For example, virtual-globe technology, with 3D visualization of the proposed built environment for participatory planning is presented in Wu et al. (2010).

## 3. DESIGN CONSIDERATIONS

When designing an architecture for a system such as that proposed for PlanYourPlace, developers must consider more than simply (i) the activities that a user should preform, i.e. functions that the planning platform offers (as outlined above). One should also consider (ii) the user, and (iii) the context of use (Rubin and Chisnell 2008). Further constraints for platform design originate from the (geographic) data that will be used. The following sections discuss the types of constraints that have emerged from our analysis, and describe human and technical design factors that should be taken into consideration.

### 3.1 The user and its activities

As laid out earlier there are three general groups of users for the platform: citizens, city planners, and decision makers. However the biggest group is the "citizen", i.e. community members, who use the website to inform themselves, discuss proposals with others, and express their opinion by voting or commenting on proposals. As Rubin and Chisnell (2008) have noted, for a user-centred design (UCD) approach, it is important that designers have a close look at the cohort of future platform users. Questions that are important for the design are:

- What are the different age groups? High school students may already know how to use PlanYourPlace social network functions: such as creating a profile; adding content (images, movies, etc.); commenting on messages; or discussing with others, from their own experience with social networks. Whereas a person that has never used a social network may be overwhelmed by the options, and will require some assistance to learn the functionality.
- What is the computer literacy of the users? Do people use a computer daily, or just occasionally? Hence, do they feel comfortable with computer use? If not, then they may need an introduction to the platform, which can be in the form of training (e.g. held in a community centre), a user manual, or an online demonstration, etc.
- What do people know about planning processes? If they have participated in Charrettes and community planning events before, then they will likely understand how the information they provide will be used. In that case they may also understand various planning terminology, and the steps taken to move through a planning process. If not, the system needs to educate the users about these issues.
- How can we ensure that disabled people can access the information and participate in discussions? What are the planning issues that may interest them in particular?
- How can we ensure anonymity and privacy? Both points are important. For instance, a user may have an opposing opinion that they wish to contribute to a discussion, but

choose not to as it may bring them unwanted attention (Gutmann et al. 2007), or real life attack.

- How can we ensure that votes and comments stem from a real person? i.e. how can we avoid having one person (or a computer) use several identities for voting and discussions?

Given the platform requirements, and the questions posed above, platform design should consider several points: (i) design an interface that is accessible for different age groups, novice computer users, and disabled people; (ii) provide educational material (online and for download) for novice users on website use and planning processes; (iii) allow users to contribute anonymously; and (iv) ensure that each contributor has a unique identity.

### 3.2 Context of use and data access

While the reflections in the previous section influence functional and content aspects of platform design, the "use context" of the participatory planning platform strongly influences the technical aspects, i.e. the technical architecture. Important design considerations with respect to use are:

- Users need to be able to access the platform from home (citizen), from work (city planner and decision maker), or even from somewhere on the street with a mobile device. Hence, the platform should run on different types of devices without the need to download additional software. A web-browser solution is therefore the logical choice.
- The content, i.e. documents, plans, images, etc., for each development project will be managed by the responsible agency, be it a local government, or a community group. In addition, the data that are displayed by the map interface will likely only be partially hosted within the project "website", and additional data will be "delivered" directly by data custodians (e.g., a city department). Consequently, the technical architecture should utilize a "data as a service" approach that could be based on Open Geospatial Consortium (OGC) standards (Zhao et al. 2007, Percivall 2010), for example.
- For the evaluation of proposed plans, via various assessment models, it is beneficial to "plugin" the models rather than to integrate them. Hence, the architecture should be designed in such a way that models are treated as, and accessed through a web service, such as the OGC Web Processing Service (WPS, Schut 2007). This allows addition of further assessment models over time — without changes to the system architecture — and ensures that the integration of improvements to the models does not affect other architectural components, nor cause website downtimes. Using a WPS-based architecture will also enable installation of a particular model on different computers such that distributed processing can be employed during high-demand times.
- In social networks people usually have a profile that contains personal information. Such information should not be accessible by others, unless approved by the profile owner. Hence, an authentication model (i.e. authentication manager) that controls access to data and user information is a critical component of the architecture.
- Licenses for software and geographic data need to be considered when building the system. First, licences for data may prohibit the presentation of certain types of data/information to certain user groups, e.g., a decision authority may see more information than a community leader, or *vice versa*. In addition, data licenses may

restrict access based on where the platform user resides. We wish to note here that ownership of data created by users is a related topic that must be considered (see Hunter et al. 2011). Second, licenses for software can restrict the modification/customization of the platform. They can also hinder the free adoption of the platform by communities and cities. For this reason the project employs a free and open source software strategy (Steiniger and Bocher 2009).

In summary, the five points above require that the participatory platform architecture: (i) be web-based, (ii) be OGC service standard-based for data and assessment model access, (iii) have access managers to ensure data security and conformance with data licenses, and (iv) should be implemented using free and open source software.

## 4. THE PlanYourPlace PLATFORM ARCHITECTURE

In the previous section we established that the architecture needs to be designed in such a way that: (1) users can have access from different locations; (2) data are stored in different locations; (3) data may be processed with different models maintained at different locations; and (4) user access rights and data security are addressed. All these conditions are well known from the Spatial Data Infrastructure (SDI) literature (Rajabifard and Williamson 2001, GSDI 2012, Percivall 2010). Hence, it is beneficial to build on the implementation experiences and technical standards that are used for SDIs when developing the PlanYourPlace platform architecture. An important set of standards for the implementation of SDIs was, and continues to be developed by the OGC. These standards allow transfer, manipulation, analysis, and display of geographic data. Building from those standards, we have developed a physical architecture for the PlanYourPlace platform (see Figure 1). Before discussing the architecture we first review the OGC standards necessary for implementation, and then introduce some examples of how the architecture should function.

The OGC standards that are relevant for the platform and that are depicted in Figure 1 are:

- The Web Map Service (WMS) standard to deliver map like representation as images.
- The Web Feature Service (WFS) to send, receive, and update geographic data in vector format.
- The Web Coverage Service (WCS) to query and access (geo-referenced) images and terrain data.
- The Web Processing Service (WPS) to transform and analyze geographic data.
- The Styled Layer Descriptor (SLD) standard to describe the cartographic styling of a map requested from a WMS.
- The Simple Feature Specification (SFS), the Keyhole Mark-up Language (KML), and the Geography Mark-up Language (GML), which defines storage and transfer formats for the geographic data (not shown in the diagram).

Other OGC standards are also relevant, i.e., the OGC Catalogue Service for the Web (CS-W), and the Web Map Context (WMC) standard (see Zhao et al. 2007, Percivall 2010). However, as with the OGC SLD, SFS, KML, and GML standards, they are not portrayed in Figure 1, since they are used “under the hood.”

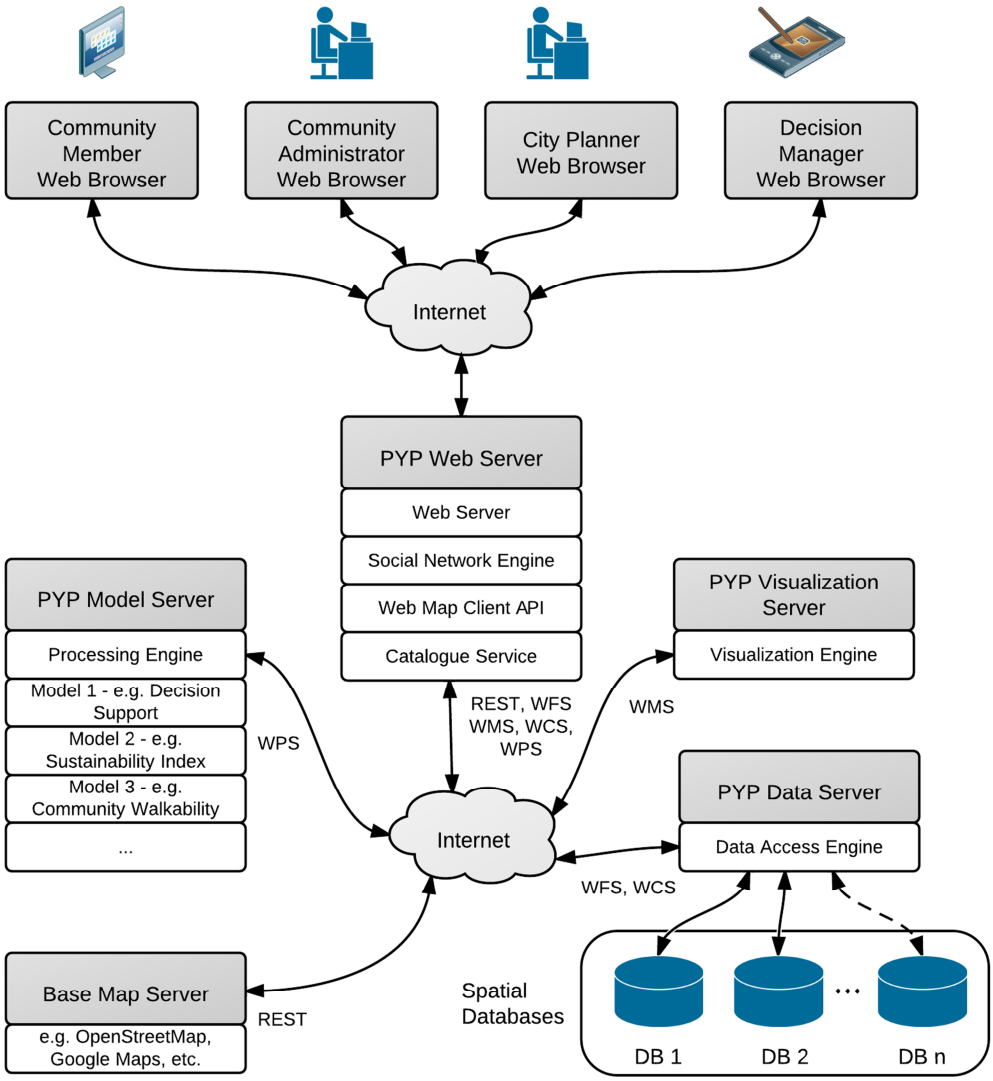


Figure 1 – Physical architecture for the PlanYourPlace (PYP) platform.

We present three examples to demonstrate how the architecture outlined in Figure 1 may work. Each example (use case) begins with a user triggering some workflow, and in each, a different result is returned. Results could be maps, reports, routes, etc.

Example (1) – (a) *Description*: The user switches from the PlanYourPlace introduction page to a map view of a community, Calgary for example. (b) *Processing*: The action is triggered automatically from the user's webpage and arrives at the PYP Web Server via the Web-Map-Client API. The Map Client API will send a request to the Base Map Server (probably using a REST-based communication strategy (Fielding 2000)), and the Base Map Server will answer the request by sending a map image of Calgary to the user.

Example (2) – (a) *Description*: The user wants to find out how a particular location fares against one or more sustainability measures relating to social, environmental, or economic wellbeing. See Schlossberg and Zimmerman (2003) for examples of such sustainability

measures. The user provides the system with the measure that they are interested in, and their location of interest by selecting the location on a map, or using the location device in their mobile phone. (b) *Processing*: The evaluation action is triggered by a button press from the webpage and arrives at the PYP Web Server. With help of the Catalogue Service the location of the "Calculate Sustainability Measure" model is identified by the PYP Model Server. Note, that there can be many such servers, and because of that we need a Catalogue Service, which registers services and their capabilities. The model is triggered via a WPS call to the model server, sending with the call the user's location, and the sustainability measure identifier that the user is interested in. Say the user is interested in environmental sustainability, the model will require information about water quality, plant species, $CO_2$, nuisance species, etc. To obtain those data the model will send a WPS request to the PYP Data Server, which returns the data that is within some distance, say 1 km, of the user's location. Then, the model does the processing: it returns a value relative to a base-point value of 100, where numbers greater than 100 represent a movement toward environmental sustainability. Numbers less than 100 represent movement away from sustainability. The result, i.e. the sustainability score, is sent back to the PYP Web Server and presented on the webpage to the user.

Example (3) – (a) *Description*: The user would like to know how walkable a community is, i.e., how accessible services are from a particular location, and how supportive the local environment is for walking. See Wilson et al. (2012) for examples of walkability measures. The user provides the system with their location of interest by selecting the location on a map, or using the location device in their mobile phone. (b) *Processing*: The evaluation action is triggered by a button press on the webpage that arrives at the PYP Web Server. With the help of the Catalogue Service the location of the "Walkability" Model is identified. Via a WPS request the Model is activated and a walking catchment for a five-minute walk is returned along with a map and a walkability score. The model sends the location of interest to a walkability service. The service has access to the (geographic) data that it needs for calculating the walkability catchment (a polygon) and the walkability score for optimization purposes, i.e. roads, topographic data, land use mix, tree coverage, streetlights (safety), bus routes, shops, waterways, etc. Hence, there is no need to ask the PYP Data Server for data. The walkability polygon geometry is sent to the PYP Visualization Server for visualization of the walkability catchment. This is done using the WMS standard. The PYP Visualization Server returns an image (or a link to an image) that shows the extent of the catchment, shops, parks, and services within the catchment. Together, the walkability score and the image are sent as a WPS response from the PYP Model Server to the PYP Web Server, where both types of information are finally presented to the user on the webpage.

## 5. CURRENT STATE OF PLATFORM DEVELOPMENT

Since November 2011 the PlanYourPlace (PYP) platform has been under active development. Prior to November 2011 we had completed the functional needs analysis described in Section 2, developed the architecture described in Section 4, and evaluated open source software to implement the architecture. The PYP Web Server is realized as a Linux-Apache-MySQL-PHP (LAMP) configuration. On that server we have installed Elgg (elgg.org, Costello and Sharma 2012) as the social network platform, and OpenLayers (openlayers.org, Hazzard 2011) as the web map client. We are currently using Google Map Services as the Base Map

Server, but are developing a cartographic style (Carto) for use with OpenStreetMap and TileMill. Finally, the PYP Data Server and Visualization Server are installed on one server, and we use GeoNetwork (geonetwork-opensource.org, Ticheler and Hielkema 2007) for data and processing service management, GeoServer (geoserver.org) to render our own data, and a PostgreSQL/PostGIS database (postgis.org, Obe and Hsu 2011) to store geographic data, and other city data. We note that the user data from Elgg, the social network, are stored in a MySQL database, and not in PostgreSQL.

To view the PlanYourPlace platform in action and explore the current state of development visit: http://www.planyourplace.ca/elgg/. Figure 2 presents two screenshots of the platform. The first shows a map view that allows simple exploration of Calgary communities, and the other shows the social network perspective.

Based on the functional needs analysis and the design considerations outlined earlier, a detailed list of platform functionality was developed, which is presented in Table 1. The development and implementation status is also indicated. Not included in Table 1 are functions that are related to the education component of the PlanYourPlace project. So far we have performed an analysis of the literature with respect to important criteria for the delivery of education content, reported in Bliss-Taylor and Hunter (2012). In addition, drafts for an instructional concept based on the E-CLASS scheme (Weibel et al. 2009), and drafts for presentation concepts in terms of (i) a storyboard-based approach, and (ii) a "tip of the day" based approach have been explored. However, as these are works in progress, we are not yet able to document the necessary platform functionality.

## 6. CHALLENGES

As we outlined in the previous section, the development of ideas and concepts for the education component of the PlanYourPlace project is ongoing. Remaining challenges include the definition of education content and development of the content delivery concept in consideration of different user groups, interaction design, and instructional design (Sandars and Lafferty 2010). Other challenges await us as well, ranging from exploration of best methods/practices for the presentation of planning content, to best practices for the integration of plan assessment models. A selection of these challenges is briefly discussed below:

*User Interface Design* — For platform functions that allow the user to report issues to the city (e.g. areas where they feel unsafe, or a pot hole, etc.), the user interface could be map based. That is we envision that the users simply place a pushpin on a map and describe what they have encountered, or their concern, in a text box. This appears straightforward, but Nivala et al. (2008), Roth and Harrower (2008), and Newman et al. (2010) found that some users of web maps had difficulty navigating the map and did not understand, or misunderstood map symbology. This makes us question if a purely map-based approach is useful. An alternative to a map based user interface is a text-based version, as commonly used by social networking systems, and adopted by Maerker.Brandenburg.de for reporting street maintenance issues. However, as Chisnell and Rubin (2008) have pointed out, the best approach is probably in the middle of the two different designs. Hence, user evaluation of each design (map-based vs. text-based) should give us direction towards a "most usable" user interface. We note that introducing navigable 3D visualizations of planning scenarios will raise similar questions

Table 1 - State of functionality implementation for the PlanYourPlace platform

| *Functionality Group* | *Functionality* | *Status* |
|---|---|---|
| Management | User authentication | ● |
| | User social network profile | ● |
| | User anonymous login | ● |
| | Create development project | ● |
| | Subscribe to development project | ● |
| 2D map viewer | Display topographic map with communities | ● |
| | Display planning projects | Later |
| | Display reported issues | ○ |
| Informing | Informing about new project in area of interest | Later |
| | Posting project news and articles | ● |
| | Uploading documents (text, video, images, etc.) | ● |
| | Reporting issues to the community | ○ |
| | Informing about latest project news | ○ |
| | Informing about hottest discussions | ○ |
| | Creating events | ○ |
| Discussing | Comment on issues and documents | ● |
| | Messaging to other platform users | ● |
| | Live-chat with others | ○ |
| | Forum / group discussions | ● |
| Ranking & Voting | Rating (1-5 stars) | ● |
| | Like & Dislike | ○ |
| | Ranking alternatives | Later |
| Evaluation | Walkability | Later |
| | Transit Access | Later |
| | Other assessment models | Later |
| Sketching | Modify development plans | Later |
| | Create new plans | Later |
| Sharing | Sharing documents (text, images, videos etc.) | ● |
| | Sharing modified and created plans | Later |
| 3D Visualisation | Static images | Later |
| | Dynamic explorer | Later |

● feature implemented, ○ feature under development

about interface design and user understanding of the information displayed (Sheppard and Cizek 2009).

*Assessment Models and Metrics* — One of the planned functionalities of the platform is to evaluate the status of current development with respect to plans in the area. The PlanYourPlace project also aims at implementing metrics that measure sustainability (Hunter et al. 2011). However, it is important to choose sustainability metrics that are understandable to, and resonate with community members. We note that in recent PlanYourPlace workshops cost was raised as an important and understandable metric (PlanYourPlace 2011). As a result

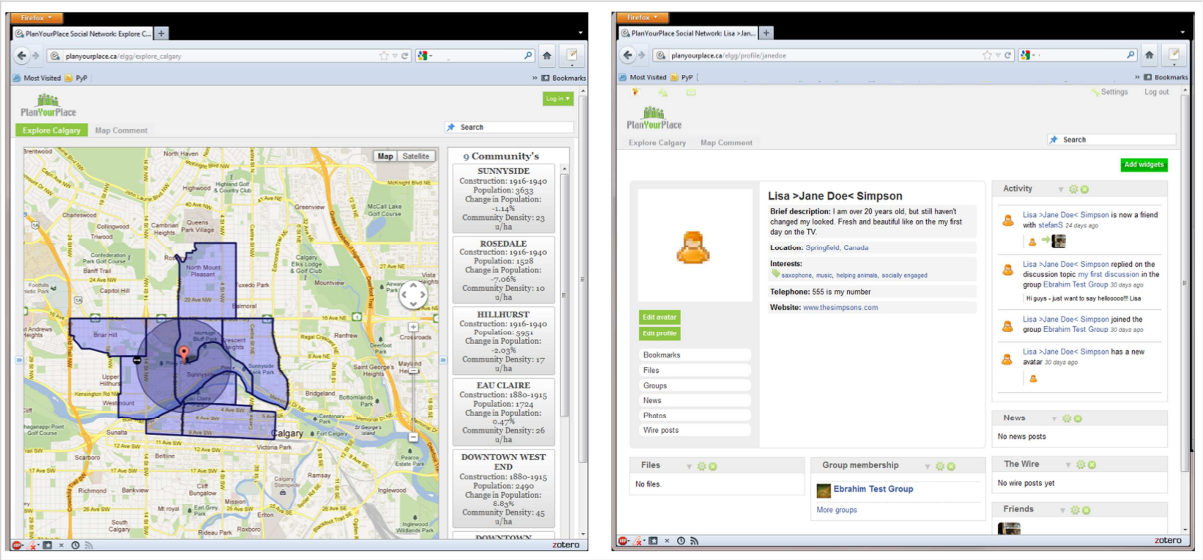


Figure 2 – PlanYourPlace platform screenshots showing a map prespective and the social network perspective

this will likely feature in our metrics, among others. Metrics will be chosen to be understandable and meaningful, and to give a holistic view of the situation so that users can make sound decisions.

*Sketching Tools* — Sketching functions of the PlanYourPlace platform should allow (i) creation of mark-ups and annotations of existing development plans, (ii) creation of new plans, and (iii) modification of proposed plans. Central questions for developing the sketching tools are: (1) How should the user be able to mark-up, modify and create plans, e.g. with a fingertip, a mouse, or a pen; (2) How should the sketching be done? Is it better to adopt the approach of planning-like games such as Sim City/Micropolis (micropolisonline.com) where the platform provides a set of objects that can be added to a plan by drag & drop, or is it better to allow free-form drawing, as one would with pen and paper? (3) What objects should a user be able to add and modify, and which should they not be able to?

An important component of the research and development on sketching will be object recognition. This is necessary, since free form sketching by the user requires the platform to recognize what the user wants to draw. Furthermore the modification of existing plans requires knowledge of what is in the plan (i.e. to identify the context). The generation and utilization of ontologies together with Bayesian inference methods may yield a promising approach for such object and context recognition (Alvarado and Davis 2004, Luescher et al. 2009).

## 7. DISCUSSION – WHAT WE HAVE LEARNED SO FAR

We gained several insights while developing the high-level platform architecture and while exploring what functions PlanYourPlace's participatory planning platform should offer. The first insight was that platform development should adhere to the principles of user-centred design (UCD). Implementing a UCD approach made us aware of the different types of user

groups that the platform should serve, and the different contexts in which a user might interact with the platform. Applying a cyclic approach to development entailing design, develop, evaluate (by users), and refine, as recommended by usability (e.g. Rubin and Chisnell 2008, Nielsen 1993) and software development experts (Laanti et al. 2011, Cohen et al. 2004), should ensure that the platform is understandable to first time users and can support citizen engagement. Within the domain of participatory (web) GIS, Haklay and Tobon (2003), Jankowski et al. (2006) and Rinner and Bird (2009) have also pointed out the advantages, and need for UCD and usability evaluation.

Second, investigating functionality requirements for a participatory planning platform made us aware that social networks possess a lot of the functionality that we believe a participatory planning platform should realize. In particular, the social networking software Elgg (Costello and Sharma 2012) offers functionality that can be used for communication among citizens, and between citizens and planners, and functions for sharing, commenting on, and voting for or against "content". Hence, when it comes to the implementation of a participatory platform it is logical to consider a social network as a foundational platform. As an additional note we point out that younger generations today often participate in online social networks. Consequently there are at least two benefits: (a) the use of a social networking platform may attract a broader cross-section of a community; and (b) there is little need to familiarize this generation with navigation, communication, sharing, and voting functions.

The third insight stemmed from a study of the required functionality and design constraints for the platform. The outcomes from the analysis were similar to requirements for implementation of a Spatial Data Infrastructure (SDI). The need for distributed data storage, data processing, and security suggests that the PlanYourPlace platform is a specialization of an SDI. Thus it makes sense to build the participatory platform based on (OGC) standards and principles that have been developed for SDIs (see the SDI Cookbook by GSDI 2012, and Percivall 2010). The high-level platform architecture for PlanYourPlace as presented in Section 4 uses these standards and adopts SDI principles.

The fourth insight concerns the need for future research on participatory planning platforms. In Section 6 we discussed the challenges related to the PlanYourPlace platform implementation. From those we can broadly define research needs with respect to (i) platform users, (ii) technical realization of functions, and (iii) new analysis tools. For instance we need to explore how platform users understand and use participatory planning platforms. We need to develop techniques that allow users to intuitively modify and sketch development plans. We need to develop new tools and algorithms that allow evaluation of user generated content in the context of existing plans, and local planning regulations. We need to investigate effective methods for the 3D visualization of proposed plans, and navigation of these proposed environments within a web browser environment.

We believe that reporting our findings to date will be helpful to those who plan to develop similar participatory platforms. We look forward to collaborative opportunities with other projects and researchers, and we welcome feedback.

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