

A Mechanism to Create Community Maps for Non-Technical Users

Claire Ellul¹, Mordechai (Muki) Haklay¹, Louise Francis², Hanif Rahemtulla¹

¹University College London, ²London21

clairee@ge.ucl.ac.uk

Abstract

The Mapping Change for Sustainable Communities project is designed to assist community groups towards greater participation in local decision making by providing them with an interactive map showing local information. The maps are managed and moderated by each community and display themes of their choice – much like a map-based community forum.

Although initially targeted at only four community groups, interest in the project resulted in the requirement to provide maps for a much wider audience, ranging from faith groups to local doctors' surgeries. Each map requires differently-themed data.

The project is managed by staff from London21 (a London-based network of community groups). Given a lack of in-house programming skills (Google Maps, MySQL, JavaScript, PHP), a method is required to allow them to set up new community sites and to add custom themes to the sites as required by each group. This paper presents a technical account of this mechanism, along with a brief description of the project and its outcomes.

1. Introduction

A UK Government White Paper entitled “*Communities in Control – Real people, real power*” [11] published in July 2008 reflects ongoing efforts by central and local government to increase community participation and generate a more vibrant local democracy. Access to information forms an important part of this process.

Internet-based Geographical Information Systems (Web GIS) have long been seen as part of this information dissemination process, as well as being a tool to encourage participation in local decision making. They have importance both in the top-down ‘information’ dissemination processes and the bottom-up ‘participation’ processes forming part of local planning activities [31]. In particular, community-

sourced mapping is of importance – information regarded as relevant by community groups is not necessarily the identical to that provided by local government (perhaps due to issues of scale, currency or trust). Government-issued information also tends to ignore local knowledge [8].

A number of free community mapping options can be identified. Sites such as Google’s MyMaps option [10], Platial [26] and Microsoft’s LiveSearch Maps [23] allow the addition of points, lines or polygons on the map. Flickr [9] allow users to geo-tag photos and share them with others.

However, despite these options, local community groups and stakeholders encounter difficulties when it comes to accessing relevant data and establishing their own Web GIS to hold information of particular relevance to the group [8]. This paper describes the implementation of a flexible Web GIS to provide a customizable resource for a growing number of diverse community groups in London. A mechanism to simplify the creation of new custom community sites for administrators having no coding skills is presented. (Given the technical detail, it is assumed that the reader is familiar with the implementation of a Web GIS.)

2. Mapping Change for Sustainable Communities

The Mapping Change for Sustainable Communities (MCSC) project [21] (which is one of 28 projects forming part of the Urbanbuzz: Building Sustainable Communities portfolio [33]) has developed web-based maps to provide communities with information about what is happening locally. The maps act as a ‘one-stop shop’ for local information, maintained by the community for the community. They form a repository for an ongoing participatory GIS process, and are an example of a GIS/2 [24],[28] application, where non-specialist end users participate in the data capture and creation processes (see [29] for an overview of Public Participation GIS).

Members of the MCSC team initially worked with four London-based communities to establish local websites (Royal Docks, Thames Ward, Hackney Wick and Archway [4]), using a standard set of themes – Large Projects (major planning applications), Our Data (community data), Events (such as fairs, cycle days, and meetings) and Organizations (charities, recycling facilities, community groups). However, dialogue with the community groups as part of the user-centered design process (see Section 3) led to the early identification of a requirement to include additional themes for each site. Two local groups (Royal Docks and Pepys Estate) have undertaken noise mapping activities, shifting the focus of the community map away from the built environment [12]. Younger members of the Thames Ward group expressed interest in uploading photographs of the local area.

Interest in the project and in the concept of a “Community Map” has also grown and requests for community maps have now been received from other locations in London (Becton, South Hackney, Brixton). Additionally, the concept of a ‘Community Map’ has appeal beyond the small local groups initially targeted – a faith-groups map has been requested.

2.1 London21

The Community Maps sites are managed by London21 [20], a small charity which promotes, supports and networks community-based initiatives for a greener, healthier and more sustainable Greater London. The organization is staffed by a mixture of full-time employees (3 in total) and volunteers.

Although making regular use of the internet to further enable their network (primarily through the London GreenMap [19] which was the first web-based green map in the world) staff do not have sufficient programming and database skills, or the funds, to create new community maps with customized themes. These issues reflect problems encountered by many third sector (charitable) organizations [17]. Thus an alternative mechanism for the creation of new community web sites is required.

3. Requirements for MCSC Maps

A user-centered design approach was used to capture requirements for the MCSC Web GIS (see [25] and [14] for details of user-centered design). *Users* in this case refers both to members of the MCSC team and to the end-users of the website – i.e. the community groups. Initial functional requirements were gathered through a series of discussions and via workshops with the various groups, who were encouraged to express views as to what types of information should be included on the map. Following first deployment, meetings with the groups resulted in feedback on the

site and suggestions for improvements and additional functionality.

A review of Google Maps[10], LiveSearch [23] and similar technology reveals missing functionality of importance to the MCSC community groups, as follows:

3.1. Moderation

Given the controversial nature of some of the issues under discussion (such as noise or planning applications), any data uploaded to the MCSC site is required to undergo moderation (by a community-appointed moderator) before it appears on the live site. Moderation also allows London21 to track who has added information, and when, and provides a measure of quality assurance for the information on the site. It also enhances community identity (see 3.4 below).

3.2 Themes

Many of the existing map generator sites allow users to enter data but provide no mechanisms to group it in a logical fashion. This makes it more difficult for users to identify and display data of interest and also limits the standardization of data capture. A more structured approach is required to allow the community to collect and present information in a coherent format and to ensure that all required information is gathered as part of the capture process. Grouping information into themes and having structured forms for data capture is particularly important given the user base – i.e. users who may have few technical skills and knowledge as to the details that should be captured.

3.3 Search Tools

Using search functionality on sites such as Google Maps [10] provides a range of results not necessarily related to the content, geographical area or theme of the map that is currently being browsed. For MCSC, searches need to be limited to the community site in question. This ensures that the results retrieved relate directly to the community, are themed and have been validated and moderated.

3.4 Community Identity

A feeling of community can be more readily created through the use of a site specific to each community, with the name of the group clearly displayed. Equally importantly, the concept of a ‘boundary’ for the area of interest of each community can help to reinforce the sense of geographic community that characterizes MCSC, rather than creating a typical online group based around a shared interest such as photography or walking.

3.5 Beyond Web GIS

Current estimates state that approximately 66% of the population of the United Kingdom has

access to the internet [2]. However, this number decreases to 59% for the age group between 55 and 64, which is conversely more likely to participate in community activities [6],[18]. Of those with internet access, a number may not have the confidence to perform tasks beyond searching and following hyper links ([15], [27]). London21 thus require an additional means of communicating with this group.

4. The Mapping Changes Approach

The limitations of freely-available community mapping tools can be overcome through the use of customization and coding. The Google Maps Application Programmers Interface (API) provides an appropriate toolkit for such development for MCSC, in particular due to its dominance (Google reports a total of 50,000 Google Maps-based mash-ups [32]). The use of Google Maps allows the MCSC project to take advantage of Web GIS functionality available through Web 2.0– high performance map display, usability, ease of implementation, integration of data from multiple sources [13], Asynchronous JavaScript and XML (AJAX) development.

4.1 Creating a New Community Map

The conventional approach to interaction with databases using PHP is to create a class for each database object (table). The class then has properties that correspond to the attributes (fields) in the database table, and methods to manipulate the data. On the client side, an HTML form is created. JavaScript code is written to validate that the user has indeed populated all required (mandatory) fields before the data is submitted to the server.

Adding new themes to the map requires the scripting of PHP code (a new class for the new theme), additional HTML (a new form) and additional JavaScript for validation. However, additional coding for each site is not an option available to London21.

4.1.1. Theme Metadata

Rather than standard classes, a metadata-driven approach is taken for the MCSC websites. Theme metadata underpins each MCSC site and is held in the MySQL database. This metadata is constructed from a pre-defined list of data types, from which the London21 administrator can select fields to construct the required theme. Rather than technical data types (such as VARCHAR, INTEGER), those under consideration here relate to the types of data that the user is required to populate on an HTML form. These include:

- *Text* and *Textareas* (single and multi-line text entry options)
- *Integers* (integer values)

- *Dates* (start and end dates for events, expiry-dates for data)
- *Singlelookup*, *Multiplelookup* (a pull-down list option on the HTML form, from which the user can select one (single) or many (multiple) values.

Using these types, a London21 administrator can design the theme in conjunction with the community and detail the information to be collected.

4.2 Handling Themes

A configuration website has been developed to allow London21 administrators to create new themes.

First, the administrator names the theme and selects a display color and icon. The second part of the theme creation process allows the administrator to add fields to the theme to store attribute information. The administrator fills in a fieldname and display name for the new field, and selects the field type. Depending on the field type, additional information is also required – for example, for text boxes, a maximum width is required; for the *singlelookup* option (which generates a pull-down option on the HTML form), the administrator must select from a list of lookup tables. They are also required to identify whether the field is mandatory or optional.

Step 2 - Select field type, fill in ALL the boxes and click *Add This Field*

The screenshot shows a web form with the following fields and values:

- Field Name* (no spaces): category
- Display Name* (can have spaces): Greenspace Type
- Mandatory*: Yes
- Field Type*: singlelookup
- Lookup Table*: Categories

At the bottom of the form is a button labeled "Add This Field".

Figure 1 - Adding a *singlelookup* Field

This process (illustrated in Figure 1 for the addition of a *singlelookup* field) is continued until all the required fields have been added. The theme can now be associated with one or more community maps.

The administrator can also create new community sites, set their boundaries and associate themes with each site.

5. The Resulting Maps

For each site, associated themes are automatically displayed on the *Map Legend*. A *Search* tab is also available, along with an *Add Content* and *Admin* option (Figure 2).

5.1 Browsing the Data on the Map

For each theme data that has been approved by the moderators will be displayed on the map and any user, whether registered with London21 or not, can browse the data on the map. Clicking on an item on the map will display information about this item.

Custom information pop-ups (Figure 2) have been created for this application, as the standard

Google Maps pop-ups move the map on display and may cover the area of interest.

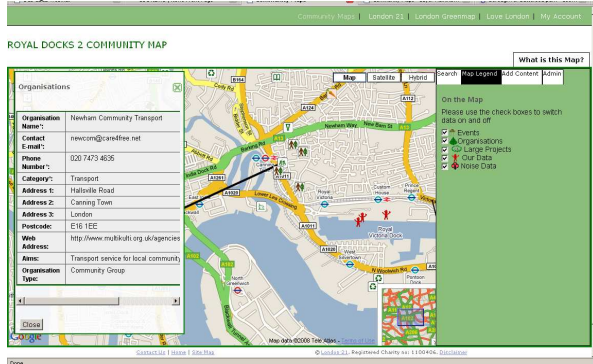


Figure 2 – The Resulting Map and Information Pop-Up

5.2 Adding Data to a Theme

On clicking the 'Add Data' option, registered users are presented with a list of themes to which data can be added. The user is prompted to draw a point, line or polygon on screen and then fills in a form with the attribute data for the new entry (Figure 3). The form to be completed is generated dynamically by querying the theme metadata in the database. A similar routine generates JavaScript code to validate the user data entry process.

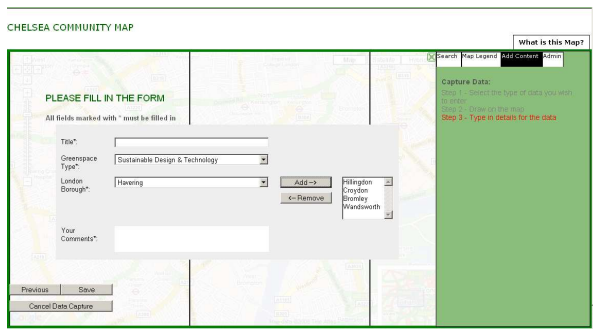


Figure 3 - Adding Green Spaces Data

5.3 Searching the Data

A search function is provided which can be configured to search all community maps, the current map, all themes or one theme. Search terms are transmitted to the server, and an appropriate SQL query string generated from the metadata for the selected theme. A list of matching items is generated. Clicking on an item displays it on the map with associated information.

5.4 Moderating Data

The *Admin* tab on each map provides functionality for local or London21 administrators to moderate data. The moderation option presents

administrators with a list of newly added or modified data. Clicking on an item in the list changes the map view to centre around the data (point, line or polygon). Clicking on the object itself shows the form for the object, in edit mode. Administrators can approve, refuse or delete data. Registered users can also make changes to their own data.

5.5 Communicating Beyond the Internet

As 80% of households in the UK (in 2006) own mobile phones [5], the MCSC team have developed a system that takes advantage of the Short Messaging System used with such phones, automatically generating a notification message for events held within a given radius of the household and matching pre-defined interests. This service is currently free to the subscriber.

6. Evaluating the Approach

The use of metadata to drive form creation in situations where multiple forms are required and their content is variable is not, in itself, new (see [1], [7], [16], [22], [30]). Indeed, a PHP class (*Clonefish* [3]) has been created for this purpose. However, our approach differs from, and enhances, those listed above in a number of respects.

Firstly, other approaches often require some understanding of databases, data types and web architecture. In contrast, non-technical users can use the MCSC site.

Secondly, metadata-driven forms have not, to the knowledge of the authors, been implemented in the context of a Web GIS and spatial data (using Google Maps or other tools). No knowledge of spatial data storage is required by the user to implement new sites.

Thirdly, the metadata generated is not only used to create forms for data capture purposes and to generate the code for validating these forms, but is also used to generate read-only information boxes for users who are browsing the data.

Fourthly, the metadata is used to implement the free-text search option provided on the website.

As a result, London21 have the functionality required to easily create and manage multiple maps, customizing each one to the requirements of a particular community group, giving flexibility without requiring the specialist coding or database knowledge, not available within such a small, charitable organization.

Additionally, should an additional data type be required (for example, a currency type) modifications can be made across the browse, edit and search functionality to add the new type. This will then be available for all pre-existing themes as well as new themes.

Although code is dynamically generated, network traffic and code footprint on the client does not increase in volume when compared to the standard PHP class-based approach (described in Section 4.1). In both cases, HTML and JavaScript is dispatched to the client from the server – whether this has been generated ‘on-the-fly’ or is pre-coded the volume of traffic is identical. Additionally, code is protected as it is not easily available for download and is not visible when the source of the web-page is examined.

One potential disadvantage of the metadata-driven approach is performance, particularly if traffic is extremely heavy. Although database queries on theme data are identical for both the class-based and metadata-based approaches, the latter requires an additional query of the theme metadata table for each operation. No formal performance measures have been undertaken as yet, as in the case of the community groups for which this site has been created, heavy traffic is not expected. Should performance become an issue, precise measurements for the various stages in the form-generation process may be obtained using time-stamp generation in the code or tools such as Firebug (<http://getfirebug.com/>) and HTTPWatch (<http://www.httpwatch.com>). Once a theme has been created, the HTML and JavaScript associated with that theme will be identical each time it is used. Further work could be undertaken to investigate the possibility of generating the HTML and JavaScript once, storing it on the server (as a text file or within the database) and then re-using the code as required.

7. Project Outcomes

The maps have been populated with approximately 500 data points to date, both by members of the various community groups and through paper-based participatory mapping exercises. The ability to rapidly create new sites has resulted in a total of six community maps rather than the four originally envisioned at the outset of the MCSC project, with more in the pipe-line. The time and financial expenditure that would have been taken to develop and configure each of the required four maps has been utilized instead for additional community engagement processes, giving London21 the ability and resources to engage with local schools and youth groups, to participate in community fairs and meetings of residents associations and to undertake additional tasks such as noise mapping exercises that were beyond the scope of the original project.

Noise mapping is particularly important for the Royal Docks community, who face the expansion of an airport in their locality. Members were provided with noise meters and asked to record noise levels at various

intervals and locations. The outcomes have been presented to the relevant Local Authorities, who have in turn now commissioned a more formal noise monitoring process (see [12] for details of the noise mapping exercises).

Ongoing engagement with the Communities has, however, highlighted an issue with regard to the moderation process - the identification of community members willing to form a steering group to undertake moderation of the data has been problematic. To date much of this process is undertaken by London21. This is particularly the case where concepts of web mapping have only been recently introduced to the community and where the groups only have a small membership. In contrast, one particular group (Archway), which has had an ongoing introduction to maps moving from paper to digital mapping over a period of two years, proved very keen to become involved in the process of moderation of their own data.

Storing the data captured by users in a MySQL database opens up the possibility of further analysis of the data. Questions relating to the quality of user-generated spatial data can be examined, as well as spatial analysis of the data captured to and text analysis of any attribute information. It is also planned to add a discussion forum, with links to individual items on the map or themes on the map, and to automatically incorporate planning applications for each area.

Further work is also required to improve the overall appearance of the site and to add tutorials, with the advantage that once this is done it is immediately rolled out across all maps.

Finally, although the MCSC project concludes in December 2009, the tools for non-technical users to rapidly deploy community maps will underpin a spin-out venture, Mapping for Change, a partnership between London21 and UCL. This will allow interested community groups and Local Authorities to access moderated web mapping at low cost.

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