

# An Approach to Interactive Social Network Geo-Mapping

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**Abstract.** People nowadays have too many useful items, which they find useless. This paper presents a concept of helping people to recycle these items by giving and lending these items. It is based on map interface and presenting information about other users and items in system via its geographical location. Data are evaluated base on cooperation with existing social network and it does not have any need to build up its own social network. The system uses web services to provide information from the server. It operates as a web application as well as a mobile application.

## 1 Introduction

There are many social networks spread around the world nowadays. Visualization of these networks represent often complicated graphs that are hard to read. Other solutions use text interface. We decided to provide a map interface support for social networks visualization. Our solution is aimed on graphical representation of social networks. To illustrate this idea we have built a system for lending and giving old and useless items. We use external social networks to be visualized on the map, so we do not build our own social network but we use item-giving and item-lending data as our own social network.

To express ideas about geographical mapping of social networks in cooperation with evaluation system we developed system called Save.

The core part of Save is geographical map of the real world. This map is used to visualize all the things and people necessary. But we cannot show the user all the things and people on the map, because it might be chaotic, so we also developed our

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own evaluating system that will sort out people and things due to the current user's activities. We do not have only static data on the map, because giving and lending items is activity where an item is moved between two points and we decided to visualize this. As well as visualizing single transfer we show stories of the items, where a user can see how many people wanted that thing and they can see its evaluation.

Save aims to have as many people as possible and to empower that idea we use external social networks, where the information about Save and information from Save are spread. Social networks are also used for people to compete and to motivate them to use the system. People can see also some of the activities of their friends and many users find that interesting.

## **2 User Interface**

The user interface consists of four main parts:

- the top control panel,
- side tab panels,
- window interface,
- and the map.

The top control panel provides the user with basic information, such as which accounts are connected or whether there was anything new of an interest to him since his last visit. The side tab panels provide the user with access to the most common functionality, while the window system is used to show the more detailed content.

While none of the three mentioned parts are meant to be dominant the map is supposed to be the main navigation control. The map has two view levels. First one is the static view, where the user can choose between showing the people or the items. In both people and items view, the user can consequently navigate through items and their owners by pointing and clicking the mouse over the dynamic content that appears as the user navigates. This view level uses IntelliView, which is a map content management algorithm and will be discussed in the following section.

The second level adds dynamics to the map, by displaying the activity of others. This activity is shown on top of the static view, be it either people or items, while the IntelliView algorithm takes care of freeing space on the map and appropriate positioning of the animation. This level can be used to show either the past activity to visually inform the user of what has happened since his last visit or the activity in near real-time using RealView, which is described in the section five.

## **3 IntelliView**

Basic concept of presentation is to visualize as many information as possible on map [1, 2]. Map is intended to serve as an information presenter for displaying friend lists, search results, history logs, routes, etc. In order to fulfil these requirements, IntelliView

provides set of functions, which manage visualization. Besides geocoding, that is inevitable to find specific location, main stress is laid in choosing and organizing elements on map.

Due to enormous number of items to be displayed, IntelliView must choose only some subset of these items in order to maintain lucid view. To accomplish this, items are sorted by priority. Priority is defined as single number and its computation varies with type of item, which is described later as *Item evaluation* in more details. Prioritization as well as some other principles, which are mentioned later, is based on most common visualization techniques that can be found in Bing Maps, Google maps, and also in well-known ESRI's geographic information system (GIS) software products. With list of items sorted by priority, IntelliView aims to achieve following basic goals:

- display as many information as possible,
- display items with higher priority first,
- illustrate density of items,
- maintain simplicity of view.

We proposed two main methods for displaying items, each of them with its own pros and cons. First, probably most intuitive method is depicted on Figure 1 and Figure 2. Items are iterated over by their priority and every time there is a check, if there is a collision. If not, the item is displayed. If there is a collision, the item is considered to be displayed with less importance and in order not to overlay those already displayed (which have evidently higher priority), their size is reduced and opacity decreased. Ordered by importance, they are grouped into several levels of importance. Visually, displayed items differ based on level, which they are included in. To maintain lucid view, items distribution is pushed to the last level, which is not displayed. Thus, visual differences among levels can be less significant. Presence of hidden items in the last level is represented by background colour of appropriate topmost item. In this manner, density can be viewed as well. Advantage of this method is accurate projection of item location, but considering priority order, items in higher levels can have lower priority than those in lower levels.



*Figure 1. IntelliView in action.*



Figure 2. IntelliView in action.

Second method tries to achieve greater accuracy of displaying priority by dividing whole viewport into grid and considering items isolated, individually in each cell. Thus, each cell has its own representative, which is dominating in the centre of this cell. Items in lower levels of importance are displayed similarly as in preceding method around cell's representative. While having improved accuracy of priority order depiction, this method has also better performance in calculation following principles of divide and conquers.

However, in this case, location of item cannot be determined due to error caused by centralization within cell. The goal of centralization is to avoid collision problems on neighbouring cell's bounds. As a positive side effect, due to uniform distribution of items on the map, this view is symmetric and more readable, too.

#### 4 RealView

The integration of social networks and the visual representation have the purpose to make the system attractive and alive over time. RealView brings the activity to the end users by showing them actions performed by others in near real time. The RealView algorithm processes actions that other users perform within the viewing area and displays them as animations on the map.

The algorithm could just show all or at least majority of the actions, but it would not be practical for a couple of reasons. First of all with rising number of actions, the traffic is rising too. Second, the purpose of this dynamic view is to bring the user activity to encourage him to be active as well, but overwhelming him with animations would rather be counterproductive. That is why we implemented a filtering system, whose purpose is to select which actions will be delivered to the individual users.

The decision process is time sensitive and is based on a modified version of the relevancy system that is used in IntelliView. The time sensitivity means that despite of not showing all of the actions in the viewing area, the algorithm still has to be aware

of the rate at which the actions happen. When implementing the mentioned features, we cannot work in true real-time. The basic idea is to stack the animations in a list, putting a delay interval between them that reflects the activity rate.

We briefly introduce two specific implementations of this concept. The first algorithm maintains an ordered list of actions and the number of actions from the last animation. Then every time a given number of actions are processed, it picks the first one and displays its animation. The ordering is performed in a following way:

- when an action is intercepted, its relevancy value is calculated,
- all actions with lower relevancy are dismissed from the list,
- the processed action is added to the end of the list.

This ensures that the first action in the list has always the highest relevancy and that we keep all consequent animations.

The second algorithm is a simplification of the first one. It stores only one, most relevant action and the number of actions from the last animation. Then every time a given number of actions were processed it displays the stored animation.

## **5 Social networks**

The system does not build its own social network, it uses external networks of Facebook, Live or Twitter. On the other hand, we maintain our own action-built network. In this network users are connected by its same interest in some sort of things. To provide recommendations, we use keywords of the current item and its synonyms. Users and items are also user-evaluated.

Currently, we aim our main focus to the biggest social network – Facebook. Since our system is designed to be open to other social networks, it is easy to integrate them in the future and to extend system availability. Integration of social network is two-way. The user can authenticate with his social network credentials and use our system with the same friends. But on the other hand there is sort of integration to his Facebook account. Our system provides triggered updates to user's wall including photos of things he has provided, things he has borrowed or lent, and events he has done etc. and regular updates with user statistics, social impact information and posts about successful stories. All these updates are controlled and adjustable, to lower the measure of spam.

In addition to common statistics of the user activity, there are statistics provided by user geographical location. They include amount of welfare done in his location, statistics of users from his neighborhood and especially comparison with neighboring regions and countries. This indirectly leads to geo competition and bigger interest in our system.

## **6 Save – the system for recycling items in social networks**

The system core was designed as a WCF (Windows Communication Foundation) web service that can be used by different clients to provide functionality to the end user (see

Figure 3). The client list consists of a Silverlight application that provides most of the system core functionality, a mobile application that is intended for quick access to some of the main functions and a Windows gadget that will just inform the user of various events in the system. Since the functionality is fully in hands of a web service, the system is open for new clients. The only thing that the client is required to implement is the authentication process, briefly described below.

To simplify the registration and authentication process and to make it more attractive for a new user to join the community as well, we have opted for a login system, where the user can use his existing account form other web service to authenticate himself. Since our aim is to encourage people to help and we intent to promote this help through currently most intensive services – social networks, we have chosen Facebook and Twitter service to provide this authentication. This base can be further extended in the future. The process of authentication mostly involves the client application that takes care of acquiring the valid session keys from the credentials provider and provides them to the service core.

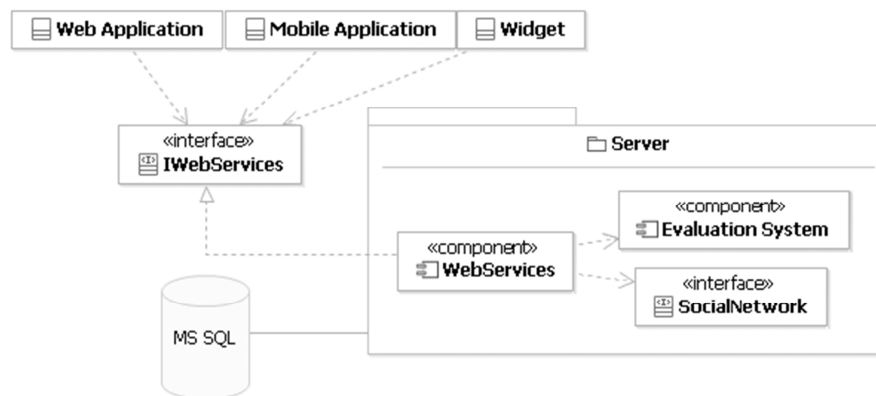


Figure 3. System architecture.

## 6.1 Web services

The system uses service-oriented architecture [3] using Windows Communication Foundation. This way client can abstract from the functionality that is provided by server. Using web services avoids client from manipulating with data directly, because the connection to the database is provided by them. Because business logic is moved into one place (server), it is far easier to modify that code only once. It also provides the interface that can be used by plenty of applications. Our system is both a web-based application and a mobile application and it is also integrated into Facebook by editing its source code via proxy or the web browser, but the business logic itself is contained into web services used.

## 6.2 System extensions

Users are informed about recent news without being on system web site also. They can use add-ons to various browsers, widgets on operating system desktops or install small

applications to their mobile phones. In all these extensions there is provided lower functionality with basic but significant information. More complicated tasks are redirected to main web application.

When a user uses our browser add-on, communication with the server is redirected through our proxy server. The proxy server augments our system integration to the Facebook. More relevant information can be seen, better information structure can be seen and better Facebook layout is provided.

### **6.3 Item evaluating**

Our system works with many items and many users with different point of interest. Apart from standard searching for items, the system has to provide ordering of items, which is based on interests and categories of current user and also similar users, evaluation of items in system and evaluation and score of the user, which wants or offers the item.

First of all we aim on the point of interest [5] of the current user. We check his activity in the system and things he get or gave the system recommends items from the same item category, parent category or the system finds items based on key words and words connected using synonymic dictionary. This is performed by Spreading activation algorithm [6] with the current user or any of his items as source and we spread the initial energy from there.

Second of all is looking for similar users [5]. Similar user is the user, who looks for the same categories of things and searches for the same keywords. Based on the similar user, we assume that things wanted by the similar user might be wanted by current user also. We used HITS algorithm [7] assuming the current user. Therefore the items he references are assumed to be trustful as well. Next we find a user that references these trustful items and we consider him trustful also and then we recommend the current user the items, other trusted users referenced.

After checking for similar user we filter items based on the item's evaluation by other users. Every user is free to evaluate items offered by other users. They can evaluate these items by number, which is used for the purpose of the system, and by comment, which is far more useful for other users to communicate. Items are evaluated by users' rating and they are also evaluated by number of visitors. These states are handled by PageRank algorithm that assumes, that the item or user is that better that more times it is referenced [8].

The last part is to order these items by the offering or wanting user's evaluation by other system users and by his activities done in system. Users that have better evaluation are more competent and responsible and items provided by them will be sorted before irresponsible users with miserable evaluation.

## **7 Conclusion**

This paper presents new modern ways of presenting information from social network via map interface. Our system demonstrates usage of this information in cooperation

with giving subsystem. That concept can be easily changed to track some other information connected to these users.

This paper also described our system that is used as a mediator between users, one donor and another one, acceptor. The system aims on solving problem of recycling items making them cycle again and not just go to trash and it aims on helping people in need as well. The system is also designed to provide lending service between users a tracing the items given and lent.

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