WeGovNow: A Map Based Platform to Engage the Local Civic Society

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ABSTRACT

In this paper we describe the advancement of WeGovNow, an Horizon 2020 European Union project involving twelve partners from Germany, Sweden, Greece, Italy and United Kingdom, aimed at using state-of-the-art digital technologies in community engagement platforms to involve citizens in decision making processes within their local neighbourhood.

Different software components, both previously existing and developed specially for the project and covering separate aspects of community engagement, were integrated in a single web platform offering an homogeneous experience to the users. One of the main common threads beyond this integration process is the ability to collect crowd mapped information and show them back to the users in an engaging way on maps, harmonizing data coming from the different components and making the mapped space easily explorable.

CCS CONCEPTS

• **Human-centered computing** → **Collaborative content creation**; **Geographic visualization**; • **Applied computing** → **Cartography**;

KEYWORDS

Geographic visualization; Collaborative content creation

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1 INTRODUCTION

In the last years many expectations have been built toward what information and communication technology could do to transform public services and bring them in the 2.0 era, obtaining services tailored around the needs of the citizen - able at the same time to support user enpowerment, collaborative production of service and the re-use of public sector information. Up to now the advancements made fell behind these expectations [4], with the transition from "e-Government" (citizen as customer) to "We-Government" (citizen as partner) remaining as one of the the next big steps to be taken in the public sector [10].

Against this background, WeGovNow [5] builds upon earlier research and development work concerning both citizen- driven systems for local public service improvement and digital neighbourhood platforms. It is a joint effort platform made of several software components which allow people to report problems and suggest improvements, to discuss their relevance, explore ways to fix problems through collective action, find solutions to compensate for resource shortages , debate topics of strategic nature, and develop and vote upon concrete suggestions for local policy action.

Clearly a central aspect for all these features is making the citizens able to explore what has been reported and discussed regarding the area where they live in an effective way - thus making interactive maps one of the pivotal components of the platform. The idea is therefore to have all the different components interact and converge to create a modern volunteered geographic information

system fostering collaboration between citizens and a smooth and streamlined communication channel with their municipalities.

This paper briefly describes the single components of WeGovNow and then discusses the architectural choices that were followed to integrate them, focusing mainly on the ones devoted to manage input and output of the geolocalized entities in the different components in an intuitive manner on a map, namely InputMap and AreaViewer.

2 THE GLOBAL INFRASTRUCTURE OF WEGOVNOW AND ITS SINGLE COMPONENTS

To develop a digital platform for effectively engaging local civil society in the co-production of citizen-centred services and in the co-development of strategic approaches to community development the main objectives are:

- Display all user activities on a user-friendly, OpenStreetMap (OSM) [11] based map interface in ways which boost interest according to user preferences and location in time and space
- Allow users to interact with each other using social network features
- Enable the integration and presentation of any relevant open public sector information (PSI) in ways which help raise awareness and trigger discussions addressing issues of community interest
- Effectively support collective formation of opinions
- Automatically match users and their concrete requests and offers (e.g. concerning participation in collective action and peer-to-peer exchange of neighborhood support), according to user interests, their time-space preferences and the characteristics of their requests and offers

To reach these aims the platform exploits the inherent potential of leading edge digital technologies in the area of collective peer-production, volunteered geographic information (VGI), re-use of open PSI, trust-building in (partly) virtual communities, and collective opinion formation.

The WeGovNow platform aims to be deeply interlinked with existing crowd-sourcing and open data repositories and the participating stakeholders' IT systems, complementing the ICT infrastructures already existing in the participating municipalities rather than replacing them (See Figure 1). This interconnection is achieved through OnToMap [1] and its semantic representation of external data through a well-defined ontology. In more operational terms, this approach enables for instance adding a map layer with bus stops, open pharmacies and the like on top of the WeGovNow functionalities described earlier.

2.1 Single components

2.1.1 FirstLife. An urban data platform developed to connect crowd sourced and institutional information concerning urban life. Technologically it is based on a noSQL backend providing REST APIs for CRUD operations on places, events, news, posts and groups - geographical coordinates are stored via GeoJSON. MongoDB was chosen for its seamless management of GeoJSON and the flexibility of data modeling that it offers. Users can collaborate in mapping

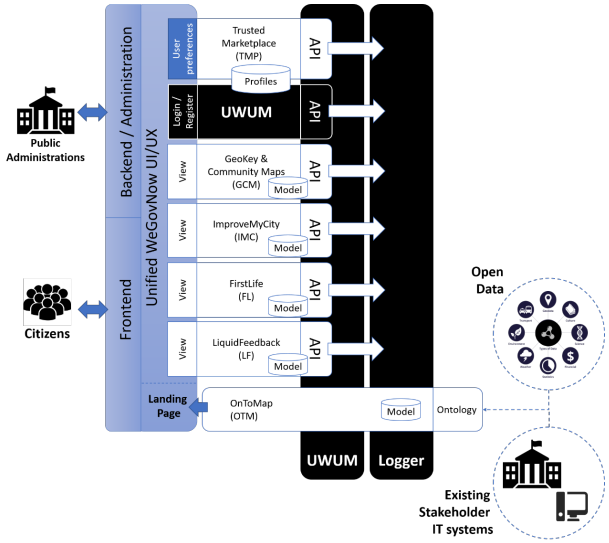

Figure 1: The overall conceptual architecture of the WeGovNow platform

the city and share different points of view about the same urban entities. Users can explore the data according to time and space dimensions, in terms of different scales using a timeline and an interactive map.

2.1.2 ImproveMyCity. An open source, scalable platform that enables residents to directly report, to their public administration, local issues about their neighbourhood such as discarded trash bins, faulty street lights and the like [12]. The reported issues are automatically transmitted to the appropriate department in the public administration to schedule their settlement, while their progress is traceable on the web site.

2.1.3 LiquidFeedback. The collective opinion formation and participatory decision making component that can be used to organize discussions among stakeholders and allow citizens to express their opinions. This is done in a transparent process, using collective moderation, proxy voting and preferential voting [2].

The LiquidFeedback process consists of a deliberation phase (to consider pros, cons, and alternatives) and a voting phase. The deliberation phase identifies viable voting options. Minority points of view get a fair share (proportional to the actual number of people supporting these views), but noisy minorities cannot dominate the discussion process. A preferential voting system allows that proposing alternatives during the deliberation phase does not harm a general idea because it is possible to vote in favor of several alternatives and rank them. In the context of the WeGovNow project, LiquidFeedback acquired geospatial indexing and search capabilities. Within WeGovNow, LiquidFeedback also provides the Single-Sign-On and integration framework based on an OAuth 2.0 service (see 3.4).

2.1.4 Community Maps. A flexible and stylish participatory mapping frontend to visualize data, compare information, and encourage conversation about the places which matter. It make use of

the GeoKey public REST API, the separation between GeoKey and Community Maps allows to separate the user interface for project management and the simpler one for data collection/visualization.

GeoKey will allow project administrators (this relates primarily to municipalities but may also be applicable to key third sector organizations) to create bespoke maps in which they can define the data structure required within different categories of their choice, then citizens will be able to interact with those projects based maps via Community Maps.

2.1.5 TrustedMarketPlace. The purpose of this component, developed specifically for WeGovNow, other than implementing a marketplace for goods and services, is to design a robust reputation management mechanism that will impose trust among the users of the match-making procedure as part of the overall Trusted Marketplace. The main idea is to suggest posts to registered users based on their interests, and also to match requests offering support or cooperation based on trust among the participating parties.

Enhanced User Profile Management is a module of this component whose purpose is to provide a single entry-point to user's preferences, personal profiles and interests across the platform.

3 INTEGRATION OF THE DIFFERENT COMPONENTS

One of the aims of this project was to integrate seamlessly different components creating a homogeneous user experience without having to rewrite completely already existing software. The platform has been realized via a layered architecture approach which integrates the previously described components within the overall system in conjunction with:

- a mechanism for orchestrating user management such as registration, single sign-on authentication, profile handling and in general trusted accreditation (UWUM)
- a mechanism for keeping track of actions in a unified manner across components (OntoMap [1] and its Logger)
- a common entry point for the whole platform providing a map-based overview of the current status of the application (LandingPage)

Each of the individual software applications that have been integrated into the overall platform has its inner coherence in terms of data, functionalities and interfaces. However, in terms of WeGovNow platform components they have been harmonized to add value beyond their implementation as standalone solutions.

Having a distributed system made of different components that interact together via two well defined hubs (UWUM and OntoMap) made it possible to proceed with the development separately across different consortium members and being able to obtain a single integrated web page even if some of the underlying technologies are different.

3.1 OnToMap and OnToMap Logger

These components are used as a container of Open Data, as a cross-application data integrator, and as a centralized user activity logger for tracking user activities. The data integration support underlining all these functions is achieved via a semantic knowledge representation layer which supports the mapping of heterogeneous domain conceptualizations to a common terminology. This terminology, defined in the OntoMap ontology, is used for generating a unified user activity log that captures the actions performed by users in all WeGovNow applications and an integrated view on the information about geographical objects shared by them.

Given the ontology, the centralized logging and the integration of information are achieved by collecting log data pushed to OnToMap by WeGovNow applications, and by applying concept translation rules for the translation of data expressed in an external format to the unified format of the OnToMap Ontology (JSON or GeoJSON).

The goal of the common logging of user activities is to overcome the limitations of local activity logging, which would provide each application with a partial view on how users are interacting with the platform. To this end a centralized model is adopted, where applications push their log data to a single component (the OTM Logger), which again merges the information managing a unified history of user activities. The Logger thus provides a unified view on the data shared in the whole platform, including the Open Data managed by OnToMap, in order to enable different components to share all the information collected about user activities, geographical objects, initiatives and issues.

3.2 InputMap and AreaViewer

To further enhance integration a unified location map-based module has been developed to input spatial coordinates within different components, improving the overall look and feel by adopting a common solution platform-wide. InputMap is a web map module connecting users input on a map with entities of the geographical data source provided by an ad hoc tile server integrating official open data and OpenStreetMap entities of the project areas. Its main function is collecting user's location input and sending information to the "hosting" component.

In particular these information comprise:

- Latitude and Longitude and current zoom of the map
- AreaId, identifier of the selected area (if applicable)
- OSM Id, identifier of the geographical entity (if applicable)
- Name and type of the geographical entity
- Address and display name provided by the reverse geocoding service of OpenStreetMap, Nominatim [8]

InputMap can be used even when there are no geographical sources available. The extra information about zoom level in combination with latitude and longitude can be used to infer the reference later on, as new geographical sources become available.

Reverse geocoding of coordinates is used to enrich user's input retrieving the closest address to their input on the map. The result of reverse geocoding is included in the overall result, and could be exploited in case the TileServer does not contain information regarding specific coordinates. The geocoding service is also used to support address-based geolocation via a search bar.

While InputMap is a component devoted to get user inputs the AreaViewer is used to provide a map based view of the data aggregated by OnToMap. It's used in the Landing Page, the initial webpage shown to the users.

AreaViewer has two main operating modalities: "explore" and "focus". In the explore status it is possible to pan and zoom the map, changing the view port, and to filter entities according to the

WeGovNow components that originated them. Clicking the map will cause to switch to the focus status, highlighting the clicked area, showing only the entities within it, and hiding outside ones. In the Landing Page titles and dates of selected entities are listed nearby the map and are links to the entities within the belonging component.

These components are both based on Leaflet and Leaflet VectorGrid plugin [7].

3.3 TileServer

InputMap and AreaViewer require to access to a common source of geographical data to render an interactive layer on a web map. In order to provide a fast and standard access to web map components, a tile server has been developed and deployed.

Specifically, it provides endpoints to obtain details of a given area given its ID, the ID of the area found at a given zoom level for certain geographical coordinates, a list of the areas contained in another one and vector tiles.

3.4 Shared User Login, Profile and Style Service

A single authentication server, implemented via the Unified WeGovNow User Management (UWUM), an integrated part of LiquidFeedback, allows users to access all the components with a single login.

UWUM allows the distributed operation of the WeGovNow applications as well as third party applications (existing e-government applications and future applications) while the users experience the system as one seamless service.

A style service was introduced as part of UWUM to provide the style customizations to instances of WeGovNow (colors of a municipality, fonts, icons) to ensure an homogeneous aspect. In addition to this all the components are in the process of converging towards the Material Design framework [9].

Other features aimed at creating a unified user experience and overall integration of the platform are the availability of a navigation endpoint, which allows applications to incorporate a common navigation bar into their user interfaces, and a service discovery endpoint that returns a list of all applications within the system and their capabilities/protocols.

3.5 pgLatLon

Another software developed for WeGovNow should be cited when focusing on the map related components: pgLatlon, a spatial database extension for the PostgreSQL object-relational database management system providing geographic data types and spatial indexing for the WGS-84 spheroid. Specifically it is used in the LiquidFeedback backend and besides offering efficient indexing of geographic objects, provided using space-filling fractal curves, it also implements a “fair” distance function for geographic entities [3].

When one wants to sort LiquidFeedback proposals for a user considering geographical distance to the user’s position and total preferences as criteria one possible approach could be to use the shortest possible spheroidal surface distance divided by the total number of preferences, but the obvious drawback is that proposals with a large size could gain an unfair general advantage being nearer than small sized ones to all possible user’s positions. To address this issue a fair distance, described in detail in [3], has been implemented inside pgLatLon.

pgLatLon is licensed under the terms of the liberal MIT-License, which avoids license problems that may arise with other spatial database extensions - besides licencing issues a separate plugin was developed, instead of using SQL queries, for efficiency reasons.

3.6 Data Quality Assessment

Data quality is one of the most important factors for success of E-Government solutions. A data quality concept for the WeGovNow platform was developed. In the frame of the platform, ground-truth reference datasets are not available. Thus, data quality is assessed intrinsically and comparably. OpenStreetMap is a base map for all WeGovNow components. Additionally, Open Data provided by municipalities are delivered by the platform in form of vector geo-spatial layers. Since OSM provides rich metadata and the full history dump, it is possible to assess OSM data quality in pilot sites intrinsically. Then, quality of Open Data provided by municipalities is evaluated in comparison to OSM data with defined quality. Additionally, OSM and Open Data with defined quality are utilized to improve users’ input. Currently, the following tools for users’ input improvement are available: auto completing, spell checking, auto snapping, and object picking. The Geo-Spatial Data Repository [6] web service implements the described tasks. Data quality assessment results are available in form of interactive maps. Tools for users’ input improvement rely on an API provided by GSDR.

4 CONCLUSIONS AND FUTURE WORK

The main development phase of WeGovNow has ended, the platform is being tested in three pilot municipalities and this will lead to bug fixes and further tailoring of the platform to the real needs of the involved participants.

More specifically the outcome of the pilots will be evaluated, in terms of viability and sustainability, both on the technical and social aspects, i.e. focusing on various stakeholders involved such as municipal staff, citizens, local NGOs and local businesses. Both quantitative and qualitative data will be gathered, using automatic usage tracking, interviews with a selected number of stakeholders and broader user surveys.

To the best of our knowledge no other single open source platform offers such an ample collection of functionalities related to civic engagement, still one of the principal benefits of the architecture is that it is easy to integrate new components, therefore other solutions that complement current features could be added in the future.

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