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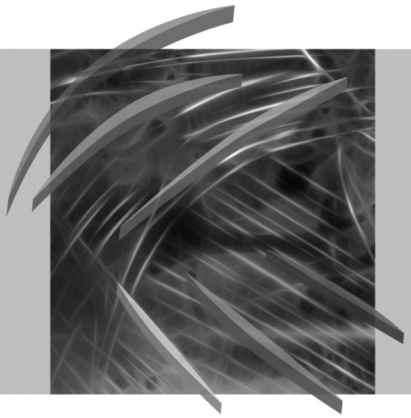

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Intelligent Technologies and Applications

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TOWARDS THE SEMANTIC WEB'S APPLICATION FOR PREPARATION OF REVIEWS – REQUIREMENTS AND ARCHITECTURE FOR THE NEEDS OF INCENTIVE-BASED SEMANTIC CONTENT CREATION

Abstract: In recent years, various Web-based review systems have provided a valuable service to consumers by allowing them to share their assessments of goods and services. In order to provide recommendations being more accurate and tailored to users' needs, review systems take advantage of semantic annotations and Semantic Web technologies. However, as users are not really interested in delivering semantic annotations of content, specific tools incorporating incentives' mechanisms are needed to transform the syntactic content into the machine understandable one. This paper presents a vision, requirements and architecture of an application offering enhanced ontology-based description of rated objects, semantic-based user profiling as well as supporting contextual semantic search. This application in comparison to the currently existing applications provides a number of incentives motivating users to participate in the review process. The application is to be available using the mobile channel and the Facebook portal.

Keywords: Semantic Web, semantic annotation, Linked Open Data, incentives, Web 2.0.

1. Introduction

According to [Gartner's Report 2007], semantics is one of top ten most promising technologies of the future. The Semantic Web paradigm constitutes a major step in the evolution of the Web. It is to enable machines to understand the meaning of information on WWW via extending the network of hyperlinked human-readable web pages by inserting machine-readable metadata about the Web content and information on how they are related to each other, thus, enabling automated reasoning [Berners-Lee, Hendler, Lassila 2001]. Its main goal is to make the Web content not only machine-readable, but also understandable by using semantic annotations. A seman-

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tic annotation is machine understandable, if it is explicit, formal, and unambiguous and this goal is usually reached by using ontologies [Uschold, Gruninger 1996]. However, the interest of users to contribute to the creation of the semantic content is rather low, due to inter alia [Shadbolt, Berners-Lee, Hall 2006; Siorpaes, Simperl 2010]: a barrier of entry – creation of semantic annotations requires specific skills and expertise in the domains such as ontologies, logic, knowledge representation; lack of incentives – most of the semantic applications are difficult to use and lack built-in incentives to use them; lack of clear benefits – the benefits of using semantic content are in many applications decoupled from the effort of creating the semantic content.

Therefore, tools incorporating incentives' mechanisms are needed to transform the syntactic content into the machine understandable one as tools automatically producing structured reviews from unstructured text still need improvement [Carrillo de Albornoz et al. 2011]. Various initiatives, e.g., an INSEMTIVES project,[1] within which the application presented in this paper has been developed, acknowledged this problem, and identified mechanisms to motivate users to dedicate more time and resources in participation in the semantic content creation process.

Simultaneously to the progress of the Semantic Web, in recent years, various Web-based review systems have appeared and provided a valuable service to consumers by allowing them to share their assessments of goods and services, thus, enabling more informed decision-making. There are enormous amounts of reviews published by users on the Web every day that constitute ideal resources for providing subjective recommendations and collective opinions. However, if the reviews would be not only machine-readable, but also understandable, then review systems could provide recommendations on various goods and services that are more accurate and tailored to users' needs. The semantic review systems are those whose performance is based on some knowledge base defined as, e.g., ontology [Peis, Morales del Castillo, Delgado-Lopez 2008]. The application of ontologies within the review system inter alia: semantically extends descriptions of user opinions; allows to complete the incomplete information through inferences; semantically extends descriptions of user contextual factors; allows for the dynamic contextualization of user preferences and opinions in specific domains; guarantees the interoperability of system resources and the homogeneity of the representation of information; improves communication processes between agents and between agents and users [Peis, Morales del Castillo, Delgado-Lopez 2008].

Moreover, as the means to access the Internet are changing [Gartner's Report 2010], review systems also have to adjust to this new situation by developing dedicated mobile interfaces. However, small screens of mobile phones and smart devices, flanked with unwieldy input modalities, provide a real challenge.

[1] http://www.insemtives.eu.

The abovementioned issues constituted a motivation to develop a Taste It! Try It! application supporting the creation of semantically annotated reviews using mobile devices in a user-friendly manner. The goal of the application is to make annotating process sufficiently easy for end-users' acceptance, while providing added value through the ease of integrating data and reasoning on it. In this paper therefore, we show requirements and architecture of an application supporting creation of faceted based annotations on mobile devices, at the same time being the social network based application.

The paper is organised as follows. The next section presents shortly the related work. Within the following section, the general framework of the proposed solution is presented. Finally, the paper concludes with final remarks.

2. Taste It! Try It! Application vs. traditional recommender systems

The Taste It! Try It! Application supports the creation of semantically annotated reviews using mobile devices in a user-friendly manner. The storyboard supported by the system is as follows. A user goes to a restaurant. While being at the restaurant, the user decides to share his or her opinion on the restaurant and its quality of service factors with other members of the community. He/she uses Taste It! Try It! to express this opinion. The application starts from capturing the position of the place (using the GPS system in a mobile device). This enables associating the semantically annotated review that is created afterwards with a specific point in space. Then, a user creates a review by providing values to selected features suggested by the application. Additionally, a user may create a free-text comment regarding the object being reviewed. The review is then uploaded to a Taste it! Try it! server and in the background the semantic representation is created. In case there is no Internet connection available, the application stores this geographically annotated semantic information for further upload. Afterwards, based on the quantity and quality of created annotations (the quality may be understood as an agreement between users regarding the given location), the user may be awarded with a special title, e.g., Polish-cuisine expert, International-food expert. This title is visible to his or her friends at the community portal, in our example the Facebook portal, with which the application is integrated. Moreover, a user may check his or her weekly/monthly/overall ranking among his or her friends on Facebook. If a number of users mark the same spot and assign the same category of place to it (e.g., restaurant XYZ), a new location appears on the map.

The created annotations could be further on used by a semantic-based recommender system while searching for restaurants fulfilling certain criteria, e.g., vegetarian, low budget, and high quality, in the neighbourhood of a user. As the semantically annotated reviews are linked to Linked Open data sets [Bizer, Heath, Berners-Lee 2009], some more sophisticated reasoning over the data would be pos-

sible and extend the possibilities offered by the semantic-based recommendation system in question.

The application is targeted at end-users among which two groups may be distinguished: data producers (contributors) – users providing reviews of places, i.e. users of the application; and data consumers (beneficiaries) – users interested in the content produced by the application, i.e. people looking for recommendations/reviews on various places. The application is to fulfil the following goals:

– to provide support while reviewing different places and sharing the information with friends via Facebook as well as enable precise and effective searching for already described entities (restaurants, pubs, etc.),
– to express the information on various venues in a semantic manner, making it machine understandable and allowing for automatic integration and reasoning over the data – the final version of the review submitted by a user is stored as RDF triples,
– to provide semantically-enabled reviews sufficiently easy to create for end-user acceptance – the process of attaching the machine understandable semantics should be invisible to the end user,
– to keep a user entertained – integrating the proposed application with the social portal such as Facebook and adding the possibility of gaining badges, are some of the incentives that are utilised to make the system more attractive to users.

There exist many Web-based review systems. An example of a very successful recommender system is Yelp,[2] founded in 2004 to help people find local businesses like dentists, hair stylists and mechanics. Up to now, Yelp users contributed over 15 million reviews. Another example, Goodrec,[3] allows users to submit their book/movie/restaurant recommendations using either the Web interface or their mobile device. So is Urban spoon[4] allowing to publish a user's activity on the Facebook wall. Other examples include: Tripadvisor,[5] with more than 40 million reviews contributed, or Polish portal Gastronauci.pl which contains 37,000 reviews of 14,000 restaurants in 1406 Polish cities.[6]

The mentioned systems provide large amount of reviews and offer recommendations on goods and services. Although quite successful, the precision of browsing and searching the reviews previously submitted is far from being perfect and usually no summary of existing reviews is provided. The users may search restaurants according to locations or a mean of stars awarded by other users. To the best of our knowledge, these solutions do not rely on any Semantic Web technologies in the background.

[2] http://www.yelp.com.
[3] http://www.goodrec.com.
[4] http://www.urbanspoon.com.
[5] http://www.tripadvisor.com.
[6] http://www.gastronauci.pl.

In turn, there exists a number of solutions incorporating semantic technologies and therefore providing precise search results e.g. [Aciar et al. 2006; Sugiki, Matsubara 2010; Carrillo de Albornoz et al. 2011] that suffer from a lack of user-generated content or aim at producing semantic annotations based on unstructured reviews. The most successful, or at least the most promoted, semantic recommender system seems to be the Revyu[7] system – a generic reviewing site based on the Linked Data principles and the Semantic Web technology stack. Revyu tries to enhance the experience of site users by consuming and publishing Linked data on the Web. This way the user's contribution is extended with the available semantic data. Although the scientific value of Revyu is worth noting, it also lacks incentives mechanisms encouraging users to provide semantic content of high quality. Another problem of Revyu is a lack of focus: a user may review anything she/he wants.

The key for success of every user-contribution based system is the incentives mechanism applied. The gratification system should be as attractive as possible and each award should motivate a user towards further contribution. The success of Farmville on Facebook showed the power of funny badges and medals published on the Facebook wall. In fact, the idea has been so widely adopted that for example Badgeville[8] is offering it as a third-party solution possible to integrate into any other system through special API. When it comes to review systems, some applications use simple flat points to award users for their contribution (e.g., Gastronauci), some use complex system of badges (e.g., Foursquare[9]) or stamps (e.g., Gowalla[10]). In addition, some of them offer publishing information of user activity on the Facebook wall (e.g., Urban spoon, mygoodeats[11]), which additionally motivates users and is a great way of attracting new users to sing up. The proposed application uses two different types of incentives mechanisms that are discussed in the next section of the article.

The reviews created using the Taste it! Try it! Application are to be published on the INSEMTIVES platform to become a part of the Linked Open Data Cloud [Bizer, Heath, Berners-Lee 2009]. The application is to use an ontology linked to LOD existing ones, e.g., Goenames,[12] Linked Goedata.[13] One of the inspirations for the developed model comes also from the Freebase portal. Freebase[14] is an open repository of structured data of almost 20 million entities.

To summarise, Taste it! Try it! is to have the following features, which together make it distinct from the already existing solutions: more complex, ontology-based

[7] http://revyu.com.
[8] http://www.badgeville.com/solutions.html.
[9] http://www.foursquare.com.
[10] http://gowalla.com.
[11] http://apps.facebook.com/mygoodeats.
[12] http://www.geonames.org/ontology/documentation.html.
[13] http://linkedgeodata.org/About.
[14] http://www.freebase.com.

description of a restaurant – not only a typical review that the currently existing recommendation systems support, is performed by a user, but also thanks to the bootstrapping algorithm, the additional concepts are added to characterize the specific feature of the restaurant, e.g. settings and environment – river, balcony, etc.; semantic-based user profiling and personalization of search results (based on a user profile); contextual semantic search taking into account e.g. spatial context. In addition, offering at least the same functionalities as already existing reviewing solutions; offering a mobile interface for creating and submitting the reviews; providing faceted based semantic annotations of submitted reviews requiring minimal effort from a user; providing incentives to contribute to the system by following appropriate usability design guidelines; providing incentives to contribute to the system by integrating with Facebook and offering badges and points for valuable reviews; publishing the submitted reviews as a part of the Linked Open Data cloud and finally, offering personalized and more accurate searching possibilities.

3. Application – requirements and system model

The application is designed according to the client-server architecture model. It has two clients communicating with the server: mobile client and Facebook client, thus supporting different user-application collaboration models. The clients have separate business logic and support different sets of functionalities, although, they operate on the same set of data. Therefore, three groups of use cases were distinguished, namely: mobile application use cases (MC), Facebook use cases (FB) and server use cases (SE). The UML use case diagram showing all functionalities is presented in Figure 1.

The first group of use cases (MC.1 – MC.6) covers all aspects of user's interactions with the Taste it! Try it! application using the mobile channel, i.e., the Android application. This client allows a user to create, manage and submit reviews of restaurants, pubs, etc. It also provides search functionalities, as well as enables a user to view the status of former reviews and his/her profile details. In turn, the Facebook-related use cases (FB.1–FB.6) cover the area of interaction with the application using the Facebook-integrated application. The Facebook client enables a user to register to the application, browse profiles of other users, reviews and restaurants. The user profile contains inter alia information on badges granted to the user and statistics of his former interaction with the application. Finally, the server side use cases (SE.1–SE.7) include functionalities that are to handle requests from the both the mobile and the Facebook clients. Additionally, the "SE.4. Collect incentives" use case aims at calculation and verification of the user achievements and provides gratification mechanisms to motivate users to create the semantic content. This functionality also processes the semantic annotations of restaurants and publishes them in the LOD cloud.

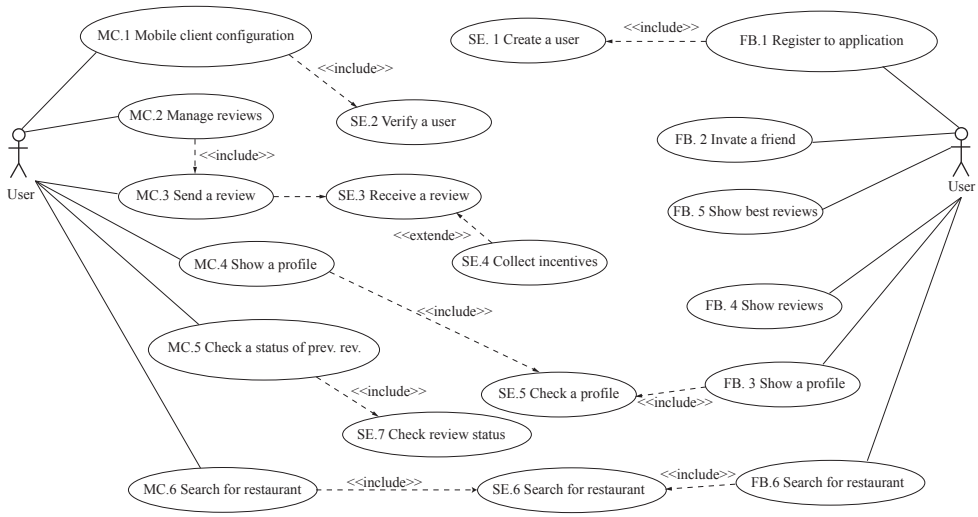

Figure 1. UML use case diagram

As it was already mentioned, the goal of the Taste it! Try it! application is also to motivate users to create semantic annotations of restaurants. While delivering the review, besides providing specific rates of a restaurant in the various categories accompanied by free-text comments, users may specify the restaurant's cuisine, available entertainment, payment options, Internet-access possibility, etc. The annotations assigned to a restaurant afterwards by the application, are derived from collective decisions of reviewers (application users). Thus, it is required to motivate users to produce reviews in considerable amounts and with a substantial level of details.

The incentives models and methods within the application may be summarised according to two dimensions: usability design related incentives, such as user-friendliness and easiness of creation of semantic annotations; and sociability design manifested through the integration of the application with the Facebook portal and usage of badges and points to award users for the activities.

The first mentioned dimension of incentives relates to the design of the application and its interface. It covers such usability design aspects as controllability, self-descriptiveness, error-tolerance, expectation conformity, suitability for task and individualization. While developing the application, our main motivation was to hide the complexity of semantics being the backbone of the application. The semantic annotations that are created are template based annotations (faceted based annotations), thus, the entire process of creating annotations is more user friendly and resembles typical interaction with the Web 2.0 application.

The second group of mechanisms includes the sociability design aspects which manifest themselves by awarding badges to users being the most active or reaching certain thresholds, e.g., for each review submitted, users are awarded with points. In turn, badges show the status of a user, his/her hobby as well as current achievements. The gratification rules define when a user is eligible to get a certain badge. Both badges and points are displayed in the profile and on the wall of the user on the Facebook portal. It allows to take advantage of the following motivation levers: reputation, competition, conformity to a group, usefulness, altruism, reciprocity and self-esteem.

To fulfil goals defined for the application, five major components of the application were distinguished, namely: server, Android client, Facebook client, Facebook and Insemtives platform. The connections between these components are presented in Figure 2.

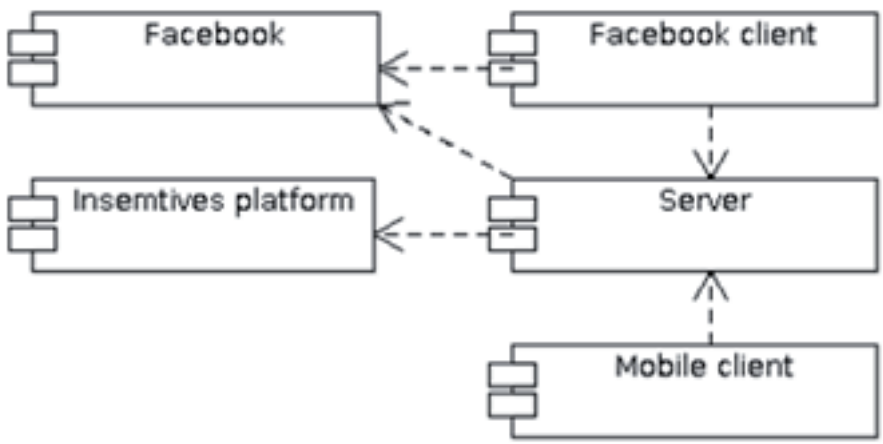

Figure 2. UML component diagram of the application

The Android client provides a user with a mobile front-end to manage reviews as well as check statuses of users and reviews as specified in the Use Cases. It is worth mentioning that it may work offline, however needs also to communicate with the server for updates or while searching. At all times the online communication must be confirmed by the user (this may be defined in the application settings). The mobile app delivers also all functionalities, which are needed to communicate with the server. To properly communicate, it requires an interface provided by the server component. The server component provides also an additional interface for the Facebook client that enables to retrieve information about the user interactions with the application, as well as about restaurants and reviews. The server also updates information on statistics, granted badges, prepares and publishes the LOD generated within the application. The server also uses the Facebook Graph API to post infor-

mation on the Facebook wall of the user, e.g., about a new review or a new badge granted to the user. It also requires an interface provided by the INSEMTIVES platform to publish the LOD. The server also provides the gratification mechanisms and verifies the annotations provided by users to ensure the quality of annotations published. The server also manages application data making it available to both clients. The Facebook client is another front-end to the application and is embedded in the Facebook canvas. It uses the Facebook JavaScript API to retrieve basic information about the user including Facebook user ID, user name, friends, location, locale, etc. This data may be used in the Facebook side calls. Various interactions between these components take place covering all of the use cases defined.

4. Conclusions and future outlook

The Taste It! Try It! application presented in this paper is to support users in the process of creation of the semantically annotated reviews. This goal is achieved by providing an application similar to what users already use and applying a few incentives mechanisms to motivate them. These social incentives mechanisms taking advantage of the Web 2.0 paradigm are to guarantee the appropriate quantity and quality (level of details) of the created semantic annotations of objects. This will in turn allow to offer personalised and more accurate search possibilities of the application, thus, constituting additional incentive for users to use the application.

The developed mobile application's features are consistent with a Gartner's analysis [Gartner's Report 2011], in which, top 10 Consumer Mobile Applications to Watch in 2012 are identified. The top 3 functionalities out of 10 identified are as follows: Location-based services (LBSs), Social networking and Mobile search. The Taste it! Try it! mobile application can be classified into each of these categories. In fact, we propose a useful and user-friendly solution to create reviews at the most convenient location, i.e., while being at the place being reviewed. Thus, the review reflects better the true impression of given place, not influenced by the time elapsed between the real experience and the moment, when the user is back at home, in front of his/her computer. The created reviews are extended with the geo-location information that is later used as one of the search parameters. So is the social context of the user, meaning e.g. activity of his friends. Finally, the user's contribution is also awarded with badges and broadcasted over Facebook.

In this way the Taste It! Try It! Application offers the added value towards the existing recommendation systems especially in the area of personalization of search results and contextual semantic search taking into account e.g. spatial context. Worth mentioning is also the integration with the LOD cloud. We believe that features of the Taste It! Try It! application provide a reasonable compromise between functionality, usability, simplicity and attractiveness from the user point of view. However, only the evaluation of the proposed solution being a part of our future work will

show whether the application constitutes a good compromise between the power of semantic annotations and difficulty of creating and maintaining them.

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WYKORZYSTANIE MECHANIZMÓW SIECI SEMANTYCZNEJ DO PRZYGOTOWANIA I PUBLIKACJI RECENZJI – WYMAGANIA I ARCHITEKTURA APLIKACJI

Streszczenie: W ostatnich latach w Internecie wielką popularnością cieszą się systemy rekomendujące. Do dostarczania precyzyjnie dopasowanych do potrzeb użytkowników recenzji systemy te coraz częściej wykorzystują potencjał technologii semantycznych. Semantyczne adnotacje recenzji mogą jednak powstać jedynie na dwa sposoby: automatycznie na podstawie analizy tekstu lub manualnie poprzez interakcję z człowiekiem. Użytkownicy nie są jednak zainteresowani adnotowaniem wprowadzanych do systemów recenzji. Jako że podejścia automatyczne nie uzyskują jeszcze wystarczającej precyzji, konieczne jest wykorzystanie mechanizmów motywujących użytkowników do tworzenia adnotacji recenzji. Niniejszy artykuł prezentuje wizję, wymagania oraz architekturę aplikacji umożliwiającej tworzenie rozszerzonych, wykorzystujących ontologię opisów obiektów. Aplikacja ta w porównaniu do wielu obecnie dostępnych w Sieci narzędzi, proponuje także mechanizmy motywujące użytkowników do działania. Ciekawostką jest to, że aplikacja w kontakcie z użytkownikiem wykorzystuje kanał mobilny, a także portal społecznościowy Facebook.

Słowa kluczowe: sieć semantyczna, semantyczne adnotacje, mechanizmy motywujące.