Using Rules to Develop a Personalized and Social Location Information System for the Semantic Web

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Abstract. In this work, the design and implementation of an innovative context-aware location based social networking service is presented. The proposed system, called "Geosocial SPLIS", utilizes Semantic Web technologies to deliver personalized information to the end user. It addresses some drawbacks of knowledge-based personalization systems and aims to provide a collaborative knowledge creation platform for other systems. To achieve this, it a) collects data from external sources such as Google Places API and Google+ b) adopts the schema.org ontology to represent people and places profiles, c) provides a web editor for adding rules (modeling user preferences and group-targeted place offers) at run time, d) uses RuleML and Jess rules to represent these rules, e) combines at run-time the above to match user context with up to date information, presented on Google Maps and f) matches user's preferences with those of his/her nearby friends to present POI's that are suitable to all of them. All data and rules are stored in the Sesame RDF triple store in order to be shared among various systems.

Keywords: Semantic Web, Ontologies, Rules, Context, Location Based Services, Points of Interest, Preferences, Group-Targeted Offers.

1 Introduction

Nowadays, a sector of Location Based Services (LBS) [1, 2], used daily by millions of people, is Location Based Social Networking Services (LBSNS) [3,4]. LBSNS are applications that provide users with the capability to locate each other and interact with one another depending on their physical distance. Two of the most popular examples are Facebook Places (https://www.facebook.com/about/location) and Foursquare (https://foursquare.com/).

Successful LBSNS should fulfill user requirements and provide them with rich and personalized information according to their profile (e.g. preferences etc.) and their environment (location, day, etc.), usually referred as context [5]. Consequently, researchers focus on enhancing contextual knowledge collection and perception process by developing a) hardware structures (e.g. GPS, sensors) and b) software technologies such as ontologies and rules [6-8]. Concerning the second domain, ontologies (e.g.

RDF/S, OWL) enhanced contextual knowledge because they a) offer the ability to represent physical entities and the associations between them, b) enable knowledge sharing and interoperability among heterogeneous systems and c) they can be reused and extended easily [6-8]. Ontologies are often combined with rules for increased expressiveness because rule-based systems are more autonomous and proactive, being able to conceive context changes and respond accordingly without user intervention [7, 8].

In this work, an innovative location based social networking service called "Geosocial SPLIS[1]" will be presented in order to demonstrate how semantic web technologies can enhance LBSNS and offer high level personalized information. Geosocial SPLIS is an extension of a system called "SPLIS" described in [9]. SPLIS provided a web editor for POI owners to assert their own properties and group targeted offers, which were represented as rules (e.g. "If a person is a student and day is Sunday then coffee price has discount 20%"). SPLIS evaluated such kind of rules on the fly depending on regular user's context and delivered personalized offers to them. Geosocial SPLIS, apart from POI owners, provides regular users with the capability to add their own contextualized rule based preferences through a web editor (e.g. "If day is Sunday then I would like to visit a Coffee shop") in order to match these preferences with POI owners' personalized offers. Data from editor are being transformed into RuleML and then into Jess so as to be machine understandable. After that, all data[2] and rules are stored in the Sesame RDF triple store being fully compatible with the popular schema.org (http://schema.org/) ontology (adopted by Google, Bing and Yahoo). Using the above, the system evaluates data and rules on the fly and presents contextualized information on Google Maps (https://maps.google.gr/).

1.1 Related work on knowledge-based personalization in LBS

To begin with, Ciaramella et al. [10] combined predefined rules in SWRL format in order to determine the user's respective situation and, after that, a set of available services is proposed proactively to him/her. Another rule based LBS is Sem-Fit [11], which uses fuzzy rules to recommend hotels to a user. A user is able to provide an evaluation of the returning results. After that, Sem-Fit updates the rules so as to provide better results. Moreover, Niforatos et al. [12] proposed a service which informs user about nearby offers while he/she is on the move. Additionally, Armenatzoglou et al. [13] developed a flexible conference assistant that integrates Semantic Web technologies to support personalized, context-aware notifications to conference attendees.

Multiple services use social media data to achieve better personalization. An example is PhotoMap [14], which exploits rules in SWRL format to attach physical and social context to photo shots (for example where the photo was taken and who was there). Serrano et al. [15] proposed a tourist information service which combines RDF data taken from sources such as foaf profile with predefined rules in SWRL format to

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[1] Can be accessed at http://tinyurl.com/GeoSPLIS

[2] Server can be accessed at *http://platon.econ.auth.gr:8080/openrdf-sesame* and data can be accessed at *http://platon.econ.auth.gr:8080/openrdf-workbench/repositories/3*

recommend places of interest related to user profile. Last but not least, Li et al. [16] proposed a semantic-based mobile ad hoc social network that uses a semantics-aware discovery mechanism to locate users with similar interests.

1.2 Geosocial SPLIS relation to other works and overall contribution

With respect to the related works that were described above, apart from the advantages they possess, they have some disadvantages such as [15-18]:

- They use a predefined set of rules. Rule based systems are useful when enough amounts of web usage data are available and a limited set of rules cover a narrow range of knowledge.
- Designing, implementing and maintaining new rules is a time consuming process which requires a lot of effort and cost.
- Developers' rules are not always efficient for every situation or for every user.

Geososial SPLIS deals with these problems by offering users the capability to add rules dynamically at runtime through an intuitive user-oriented interface. Instead of having problems and becoming obsolete the system becomes more and more intelligent as soon as more rules are inserted into the system. By exploiting social intelligence and letting users to take part in the knowledge construction process, the system's knowledge base becomes richer and richer. Moreover, user defined rules are more consistent, qualitative and efficient than those of the developers and can provide customized information of higher quality [10].

In the following section, the design and the implementation details of Geosocial SPLIS are described, while in Section 3 the system's processes are discussed. In Section 4 some use case scenarios are demonstrated. Section 5 presents some evaluation results and, finally, section 6 discusses the conclusions of our work and indicates future directions.

2 Design and implementation

Human mobility behavior in everyday life is not completely random and presents strong daily patterns (e.g. a user visits a bar at night) [19]. People have preferences such as "if it is morning and weather is sunny I would like to go for a coffee", which depend on his/her current situation. Geosocial SPLIS general idea is to model and evaluate such kind of preferences and provide customized context-aware information, attractive to each user. In detail, Geosocial SPLIS provides users the capability to expose their preferences by authoring rules that represent them, through a user-friendly web editor. After that, every time a user is logged into the system, it gets his/her context, evaluates his/her rule-based preferences and POI owners' rules and delivers personalized information (figure 1). Geosocial SPLIS is able to handle rules that involve a) every existing property of a POI, b) user's location (e.g. I want a coffee shop which is are less than 600 meters away), c) weather and d) time-day (e.g. I would like restaurants which serve Chinese cuisine, if it is Sunday 13:00-16:00).

A variety of software technologies combined for system implementation. To begin with, Sesame [20] is used for RDF data manipulation. Moreover, RuleML (and more specific Reaction RuleML) was chosen as a rule representation language, because a) it is a powerful markup language (XML with a predefined schema) which supports various types of rules such as deductive, reactive and normative and b) it provides interoperability among various systems by allowing rules to be represented in a formal way [21]. It was selected instead of SWRL because of the fact that SWRL employs open world reasoning without default negation, while our approach needs close world reasoning (e.g. checking the context of a user, in order to decide whether a preference is in effect). RIF-PRD (http://www.w3.org/TR/rif-prd/) could have been used, but at this time is not supported by tools as much as RuleML. Furthermore, Jess was chosen a machine executable language because it is a lightweight rule engine that matches well with web technologies [22]. Also Drools [22] could have been used instead of Jess, giving similar results. To transform RuleML rules to Jess, XSLT files [23] are used. Furthermore, common web technologies such Java Server Pages (JSP), html, JavaScript and AJAX are used for visualization [24].

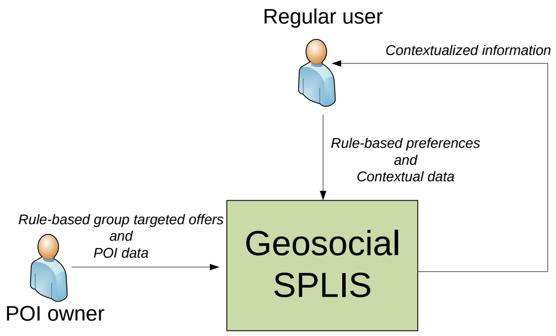


Fig. 1. Geosocial SPLIS general design.

3 Geosocial SPLIS operation process

In this section an overview about system processes is included.

3.1 Presentation of Information process

Presentation of information process includes the following steps:

1. **Data collection.** A detailed reference concerning POI data collection from Google Places API can be found in [9]. Concerning Geosocial SPLIS users, they can either fill in a registration form or login via Google+ (https://plus.google.com/) and the relevant data are stored in RDF. If they chose the second option, system collects profile data from their Google+ account (name, age etc.). A data mapping is directly done as Google+ property names are compatible with schema.org. Every time a user logs in using Google+ account, the system updates existing data to keep track of changes.

2. **Data retrieval.** After a user's login**,** data concerning user's context (profile properties, relationships, rules, time, day, weather[3]) and data concerning nearby POIs (properties, owner, rules) are retrieved from the repository.
3. **Rule evaluation.** Data mentioned above are asserted to the Jess rule engine, which evaluates both user's rules (preferences) and POIs' rules (POI owner's group targeted offers) using the asserted facts. Concerning user's rules, Jess checks the if-part of these rules (they involve user contextual properties and place data) and concludes whether a POI is interesting or not for the user.
4. **Presentation of personalized information.** Finally, data are being transferred to the client for visualization. Similarly to [9], different colour of markers on the presented map assists users to find POI's that possess valid for them offers while a star over a marker on the map indicates that the current user is the owner of the specific POI. Additionally, Geosocial SPLIS combines POI offers with user preferences. According to this, if a user's preference is satisfied for a POI, that is a user's rule is fired for that POI, then the POI is represented with a bigger marker. By clicking on a marker, apart from viewing place data, a user can also write a review, rate them, make a "like" or a "check in". The user can also obtain additional information explaining which rules were fired and why, concerning his/her rules and POI rules. In order to avoid confusion, a user rule/preference is illustrated with a person icon in front of the message and a POI rule is represented by a marker icon.

3.2 Processes concerning rules

A detailed description about POI owners and their processes concerning rules can be found in [9]. A thorough discussion concerning user defined rules, follows.

Rule insertion process. A user-friendly web interface has been designed so that users can easily add their rules through completing specific forms. A demonstration of rule creation in Geosocial SPLIS is given in figure 2, where a user asserts the rule "*If day is Sunday and weather is Sunny, then I would like an IceCreamShop*". The web interface provides fields for entering the title and the priority of the rule. After that, by clicking on the four buttons "Add...Condition" he/she is able to customize the contextual condition. The condition customization consists of a) the property field (weather, day, time, distance) b) the operator field ("is" for day or weather and "<",">" for time or distance) and c) the value. Elements concerning properties and operators are represented by read-only texts and value elements by drop down menus. This approach is adopted to resolve user data heterogeneity and avoid any mistakes. By clicking on the relevant red button, users can delete a condition. By repeating this process, they can add as many conditions as they like; a logical "AND" is implied among them.

After that, by clicking on a drop down menu they can choose the type of POI that they prefer. It is worth mentioning that schema.org hierarchy is adopted. For example if a user chose the place type "Store" all its subcategories are included (e.g. GroceryStrore etc.). In addition by clicking on the "Add Where Condition" button they are

[3] http://www.worldweatheronline.com/

able to make their rule more specific by customizing the POI properties. A property drop down menu, an operator drop down menu (“is” and “contains” for text and “<”,”>” for numbers and dates) and a value field are included.

A user is also able to add a textual explanation of the rule, so that the meaning of the rule can become clear both to him/her and also to other users. Additionally the editor provides a preview button to check the rule before submitting it and a clear button to reset the process. User can also click on one of the most popular rules, or on one of his/her friends’ rules in the left side of the screen and the forms concerning this rule are automatically filled.

The rule that is authored in the forms, is transformed to RuleML syntax (for interoperability with other systems on the web) and afterward, via xslt, is transformed to the Jess rule language, in order to become machine executable. For example, Table 1 illustrates the rule of Figure 2, in RuleML and Jess. Concerning Jess representation, a) the JESS salience operator is used for resolving rule conflict issues (it is used only in POI owners’ case if two rules concern the same slot e.g. ”If it is Saturday Coffee costs 2 €”, “If a person is a student coffee costs 1,5 €”), b) “recommendation” is called the template that stores relative places that match the rule in case it is fired and c) “EXPLANATION” is a variable for storing the rule explanation that is afterwards presented to the end user. Finally, rule data are stored in RDF triples format. Some of them are illustrated in Table 1. An extension has been made to the RDF/S ontology, by adding the corresponding class and its properties e.g. title, priority, explanation, description, ruleml_link etc. Notice that “policy_description” property is a text that is automatically created from the data the user entered into the rule forms and it is used for helping other users to understand the rule in case the rule’s creator inputs either a non-comprehensible explanation message or no explanation text at all.

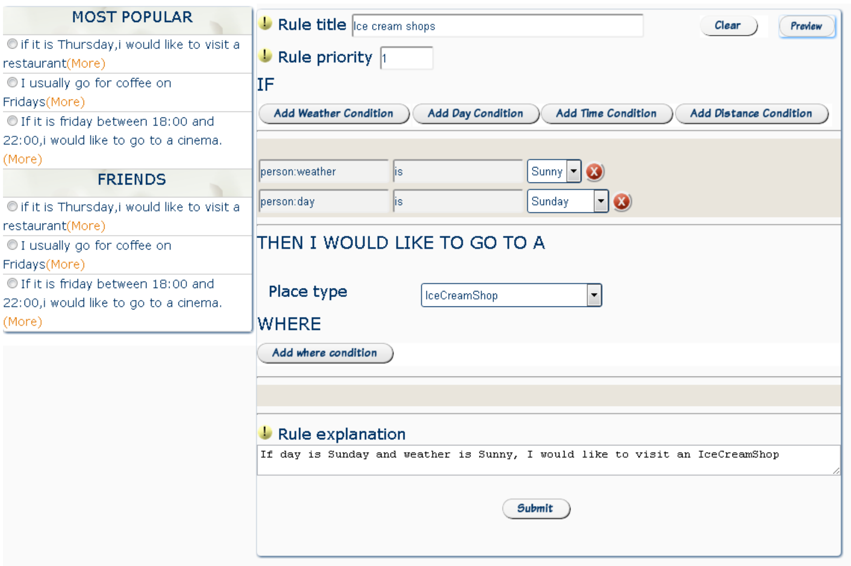


Fig. 2. Rule editor usage example

Table 1. Rule representations in RuleML,Jess and RDF format

RuleML representation

```
<?xml version="1.0" encoding="UTF-8"?>
<RuleML …">
         <Assert> <Rule style="active"> <label>drzgjtgt </label>
<explanation> If day is Sunday and weather is Sunny, I would like to
visit an IceCreamShop </explanation>
                       <if> <And>
<Atom> <Rel>place</Rel>
<slot> <Ind>type</Ind> <Ind> IceCreamShop </Ind> </slot>
<slot><Ind>uri</Ind><Var>id</Var></slot>
</Atom>
        <Atom> <Rel>person</Rel>
                <slot> <Ind>day</Ind> <Ind>sunday</Ind> </slot>
                <slot><Ind>weather</Ind> <Ind>sunny</Ind> </slot>
       </Atom>
                       </And> </if>
                       <then> <Assert>
             <Atom> <Rel>recommendation</Rel>
                <slot><Ind>id</Ind><Var>id</Var></slot>
             </Atom>
                          </Assert></then>
        </Rule></Assert></RuleML>
```

Jess representation

```
(defrule kctysfvn (declare (salience 1))
(place( type IceCreamShop) ( uri ?id))
(person ( weather sunny) ( day sunday))
=>(assert (recommendation( id ?id)))
(store EXPLANATION "If day is Sunday and weather is Sunny, I would
like to visit an IceCreamShop"))
```

RDF triples representation

```
<http://schema.org/Person#16> <http://schema.org/policy>
<http://schema.org/policy9fc1d8e4-1c39-4e36-8a35-56223cb98811>.

<http://schema.org/policy9fc1d8e4-1c39-4e36-8a35-56223cb98811>
<http://schema.org/policy_description>
"IF person:weather is Sunny AND person:day is Sunday THEN I WOULD LIKE
TO GO TO A place:type IceCreamShop".
                               ……
```

Rule modification process. A user can directly find all his/her rules and modify or delete them by choosing the corresponding icon. The same form-based interface as in rule insertion process is provided for updating existing rules.

“Get a rule” process. In order to simplify the overall process and engage users as much as possible, except from creating their own rules they are encouraged to get rules from other users. First of all, they are able to search among existing rules. Additionally, in Geosocial SPLIS starting page, a) the 3 most popular rules from all users and b) the 3 most popular rules from user’s friends are displayed, in order the users to acquire some of them if they are suitable. Furthermore, as soon as a user “check in” into a POI or “like” it, a list of the 5 most popular rules concerning the POI category is also displayed in a pop up window (e.g. if they “like” a cinema, the 5 most popular rules concerning cinemas will be displayed). Moreover, by clicking on their friends profile they are able to view and get their rules. In order to avoid confusion in rule update process (for example in cases where user A gets a rule which was created by user B and then modifies it), as soon as a user modifies a rule, a new rule is created. If a user deletes a rule, the user is simply “unlinked” from the rule so as not to affect other users that have this rule. The rule is deleted if no one else use it.

3.3 Processes exploiting social ties

Common social interaction processes. Geosocial SPLIS provides to the users the capability to search for new people and become friends with each other as in other location-based social networking services. After they select a person, they can view his/her profile data (name, age etc.) and friends. They can also, as usual send a request message to him/her, asking to become friend. After two users become friends, additionally, they are able to view each other rules.

Nearby friends. A user is also able to spot his/her friends which are nearby and find common places and offers. In this mode Geosocial SPLIS:

a) Collects i) user’s rules, ii) his nearby (logged in) friends’ rules and iii) contextual information.
b) Evaluates all the above rules and fetches the nearby POIs which are recommended by the fired rules.
c) For these POIs, it gets their group targeted offers (POIs’ rules), and evaluates them concerning all users contexts (the user and his/her friends).
d) Provides personalized information by displaying:
    - With a red marker a POI that does not have any offer at all.
    - With a yellow marker a POI that has at least one offer, but none of them is valid for any of the friends or the user at that moment.
    - With a half yellow-half green marker a POI which has a valid offer for at least one of the friends or the user.
    - With a green marker a POI which has an offer for all of the friends and the user.
    - With a bigger marker a POI that is recommended by a user rule and at least one of his/her friends’ rules.

This process is illustrated with a use case scenario in the following section.

4 Use case scenarios

A use case scenario concerning two different user profiles is presented in this section, to demonstrate Geosocial SPLIS capabilities. The scenario considers two different users, being friends with each other, having the following profiles.

a) User A ("John") is a 20-year old male student, his current profile snapshot is taken on Saturday, at 13:45 in a location A where the weather is sunny".
b) User B ("Mary") is a 21-year old female student, which is logged in the system at the same time with John in a location B, close to a location A".

After that, we assume that John and Mary have used the web editor described in Section 3 and possess the rules which are presented in Table 2.

Table 2. Users' rules

	John's rules	**Mary's rules**
Rule 1	"If it is Saturday between 13:00 and 16:00, I would like to go for coffee "	"If it is Friday between 19:00 and 22:00, find me some Restaurants which serve Italian cuisine"
Rule 2	"If it is Wednesday and time is after 18:00, find me cinemas which are closer than 1000 m"	"I would like to go for coffee, if weather is Sunny and time is before 18:00 o'clock"
Rule 3	"On Saturday afternoons (12:00-15:00), recommend me a Museum"	_

5.1 Scenario concerning individuals

As it was discussed above, after a user is inserted into Geosocial SPLIS, it evaluates his/her rules/preferences and nearby POIs' rules/group targeted offers. Considering John, rules 1 and 3 are fired because it is Saturday and time is 13:45. Consequently, available coffee shops and museums are represented with a bigger marker and are recommended to him (figure 3 below). In order to help user find easier a POI category, the marker contains the first letter of the category it belongs (e.g. "M" if it is a Museum). By clicking on the nearby POIs, John can get personalized info. As discussed above, a big green marker represents a place he would like to go regarding his context, which has also an offer for him. Taking for example the POI "Friends Cafe" which is represented with a big green marker, he is able to view a) its data b) the POI owner's message for the group targeted offer that matches his profile and c) his rule which was fired and recommended this place (figure 4a). John can also add a "like", a review or a rating to the POI. He can also view the reviews and ratings which have been submitted by other users. On the other hand, concerning Mary, the second rule is fired for her. As a result, coffee shops are represented with bigger marker and similarly, if she clicks on "Friends Café" she can get the personalized info illustrated in figure 4b. Notice that in the left side of the screen, by checking the corresponding explanations, they can directly get some of the three most popular rules a) of all users or b) of their friends.

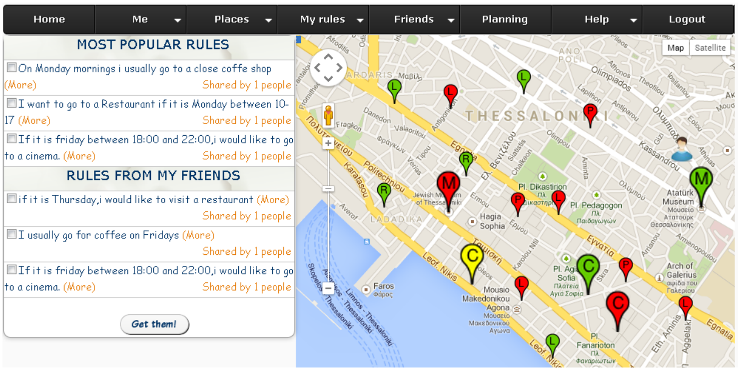
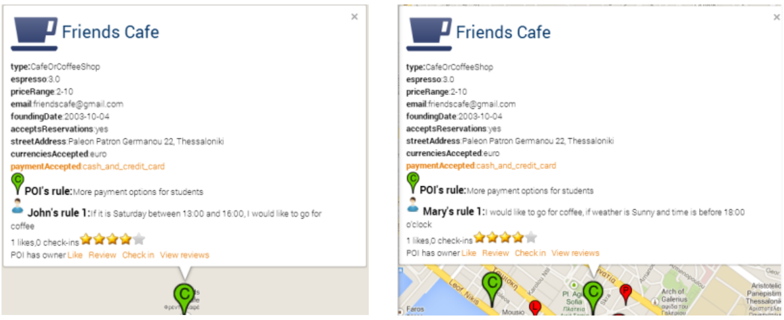


Fig. 3. Starting screen for John



a)Personalized info for John regarding "Friends Café"

b) Personalized info for Mary regarding Friends Café

Fig. 4. Personalized info concerning the two users and the place "Friends Cafe"

5.2 Scenario concerning nearby friends

By choosing "Friends"→"Nearby friends" from the menu, John and Mary are able to spot their nearby friends. Taking for example John, we assume that Mary is his only nearby friend which is logged in at this time. When he visits this page the system:

a) Gets his and Mary's context and rules.
b) Evaluates all the above rules, and then fetches the nearby POIs which are recommended by the fired rules. In our scenario John's rule 1 and 3 are fired and as a result museums and coffee shops are recommended. Additionally, Mary's rule 2 is fired, which recommends coffee shops.
c) For the POIs that result by their rules, the system gets their offers (POIs' rules), and evaluates them based on John and Mary's contexts.
d) After that, it displays personalized information as discussed in 3.3.

According the above, John's personalized info is illustrated in figure 5. All coffee shops (markers containing the letter "C") are displayed with a bigger marker because of the fact that Mary would like to visit a coffee shop at this time too. Museums are represented with a small marker for the opposite reason (they concern only John). Also on the left side of the screen there is a description of the icon colours and, below them, there is a table displaying the rules which are fired and their possessor.

By clicking on the related markers he can directly find common places with his nearby friends (big markers), places with offers for all of them etc. For example, he can directly find a POI where both of them would like to go, which has also an offer for him and Mary (a big green marker). After clicking on a marker he is able to view the POI rules (if any) and the user defined rules which are fired for this place, in order to understand a) who has an offer and why, b) who would like to visit this POI at the moment. Taking for example the POI "MOJO cafe bar" which is represented with a half green-half yellow marker, he is able to view a) that the offer is valid only for Mary (she is a female student) and b) that both of them would like to go there (figure 6a). Similarly concerning the POI "Friends Cafe", John can directly understand that both of them have an offer and both of them would like to go there now (figure 6b).

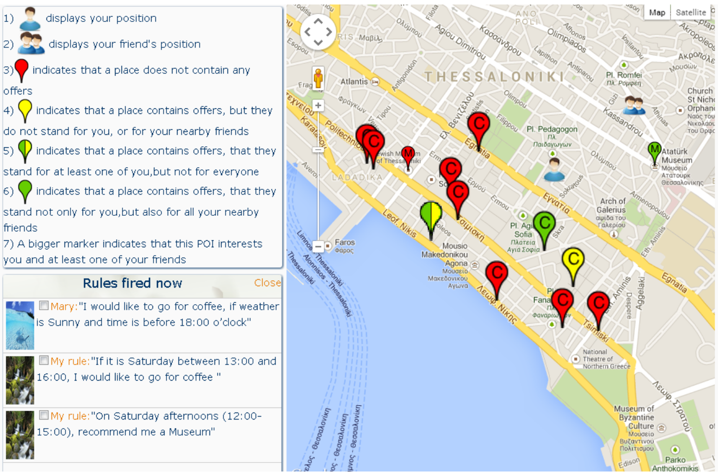


Fig. 5. "Nearby friends" mode for John

a) b)

Fig. 6. Personalized info for John regarding a) "MOJO cafe bar" and b) "Friends Cafe".

5 Evaluation

A survey was conducted to evaluate the implementation of Geosocial SPLIS. An electronic questionnaire was developed and 83 university students of a department of economics were asked to use Geosocial SPLIS and answer the questions. The survey consisted of three parts: a) processes concerning rules and the personalization of information, b) social processes and c) the system in general.

5.1 Operations concerning rules and presentation of information

After a short introductory presentation to the system's general idea, participants made an account and logged in. Initially, they added the rule "If day is Wednesday, then I would like Restaurants" and then modified it. After that, they got a random rule from another user and searched for nearby POIs concerning their rules. Finally, they answered the following questions:

Q1. How easy was to add a rule?
Q2. How easy was to modify a rule?
Q3. Are you satisfied with the provided interface?
Q4. How easy was to find and get a rule from another user?
Q5. How easy was to understand why a place was recommended?
Q6. How easy was to find a place that resulted by your rules and had an offer for you?

The results of the questions above are presented in figure 7. For every question, over 80% of the answers were "sufficiently satisfied" or "very much satisfied". Additionally, Cronbach's alpha indicator value was calculated to provide a measure of reliability. This indicator gets values between 0 and 1 and the closer it is to 1, the higher the reliability [25]. This indicator was calculated to 0.82 for our survey, showing a high internal consistency.

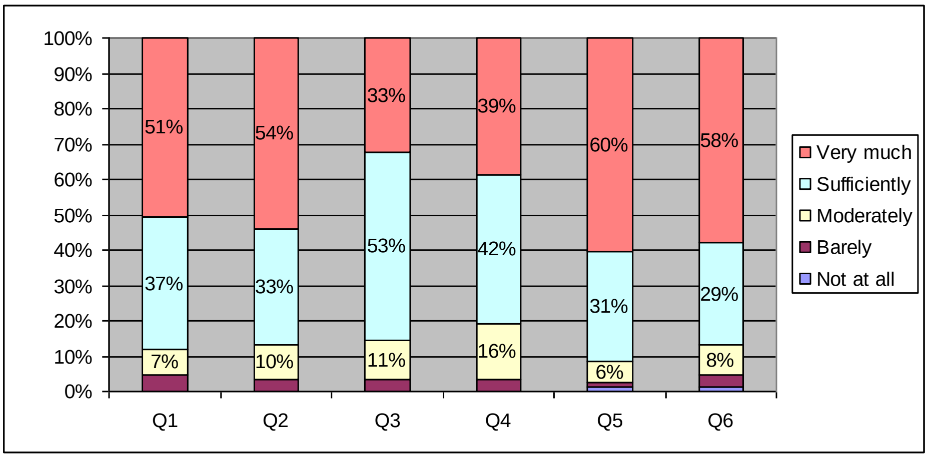


Fig. 7. Survey results for questions Q1-Q6

5.2 Social processes

Afterwards, the participants made groups of three persons, became friends with each other and tested "nearby friends' mode". Finally, they answered the following questions:

Q7. How easy was to send a friend request?
Q8. How easy was to understand which of your friends recommend a place and why?
Q9. How easy was to find common places for you and your friends?
Q10. How easy was to find places that resulted by your friends' rules and had an offer for you?

The results of the questions above are presented in figure 8. Once again, in every question, over 80% of the answers were "sufficiently satisfied" or "very much satisfied". Cronbach's alpha indicator value was calculated to 0.84 which is very satisfactory.

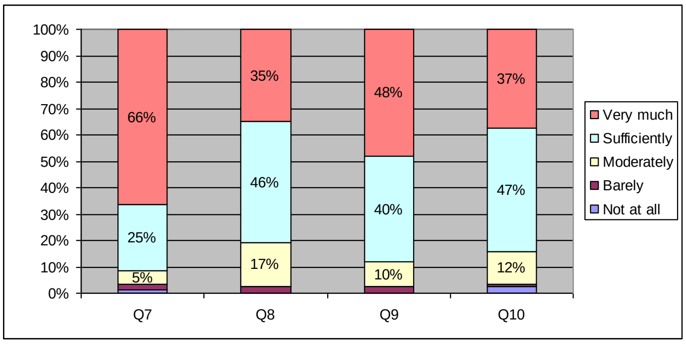


Fig. 8. Survey results for questions Q7-Q10

5.3 System in general

After completing the above tasks, participants were asked to answer the following questions related to the system in general:

Q11. Will you continue using the system?
Q12. Would you recommend the system to your friends?

As illustrated in Figure 9, 94% of the participants will continue using the system and 98% of the participant would recommend it to their friends.

6 Conclusions and future work

In this work, an innovative knowledge-based LBSNS, called Geosocial SPLIS, was designed and implemented to offer semantic based contextualized information. On the one hand, regular users enjoy proactively POIs and offers depending on their preferences and their contextual situation, and on the other, POI owners (by being able to specify their offering policy rules) can exhibit a highly targeted marketing strategy by reaching their potential customers right on time. In order to achieve all the above, Geosocial SPLIS a) collects data from sources such as Google Places API and

Google+ b) adopts an innovative, widely accepted ontology such as schema.org c) offers users the capability to create rules at run time by providing a web based editor d) transforms these rules into RuleML and Jess format and e) displays personalized information on Google Maps.

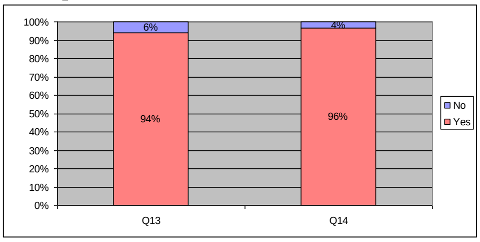


Fig. 9. Survey results for questions Q11-Q12

Geosocial SPLIS experimental testing made clear that the capability of having a dynamic knowledge base (by enabling non technical run time users to add data and rules) can provide qualitative contextualized information by addressing some of the disadvantages of rule based systems. As soon as more and more rules are being added to the system, the more interesting and intelligent it becomes because of the fact that there are rules (user preferences and group targeted offers in our case) for multiple contextual situations. High level personalized information is also achieved, since users are able to add or modify their rules according to their needs and they do not depend on the developer. Engaging non technical users to generate content is a great challenge but previous Web 2.0 examples (e.g. Wikipedia) demonstrate that this is feasible.

Geosocial SPLIS implementation can evolve in the future in various ways. The system could be enhanced by collecting data for multiple web sources (e.g. other social media such as Facebook, Twitter etc. or other available APIs) or expand the web editor to provide contextualized preferences concerning movies, videos etc. Furthermore, we are currently working on the development of a mobile version of Geosocial SPLIS for smartphones and tablets.

7 References

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