

# The Implementation of FOAF Ontology for an Academic Social Network

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**Abstract**— In this paper develop a semantic web application based on FOAF ontology as a part of an academic social network where researchers can find collaborators and share research results with others. Ontology has been used to describe users and their profiles and skills, their activities and their relations to other users and objects; consequently thereafter friends can be searched based on their interests that have been described by FOAF files. This assists to build virtual groups and expand social graph within social network without reverting to the database. This would support such applications as knowledge outsourcing and online communities.

**Keywords**— Social graph, FOAF ontology, Semantic social network, FOAF syntax.

## I. INTRODUCTION

A social networking application has experienced a surge in popularity in recent years. The social network representation shows the connections between contacts. It also illustrates how a user may be able to discover friends of a friend and friend recommendations (based on friends in common). This makes it easy for the users to build up their social network, to communicate with new people, or reconnect with lost contacts. Social networking sites allow users to share ideas, pictures, posts, activities, events, and interests with people in their network [1].

One of the primary goals of the semantic web is to describe the relation between things and the properties of things; Semantic web can store data in distributed locations and to use ontologies and reasoning to aggregate and use it.

We identify two directions of work that share similar aspects with our approach. The first one refers to building semantic models for a certain social network while the second one resources are described by meta-data, using the conceptual vocabulary provided by ontology.

Kalemi and Martiri [2] introduce a new vocabulary, FOAF-Academic, which help the academic community in saying anything about their achievements, their qualifications, activities and the communities.

Ana-Cristina and Florin [3] provide a solution to generate profiles for a person based on semantic web FOAF ontology.

Lee Kee-Sung, et al. [4] build a user-centred semantic social network to represent entities and relationships with ontology to improve retrieval performance of the semantic social network.

Shoaib and Basharat [5] propose a method for improving presentation in social web by ontology based knowledge representation that enables semantic profiling in social networking sites.

This paper presents an application regarding the use of semantic web and social network technologies to help sharing information among users and to augment the grow social graph within social network based on FOAF ontologies.

In this paper, a semantic technology is used to build up an application that can analyse data on an academic social network. The application is used to expose relationships, mainly the common interest of a group of academic researches.

## II. SOCIAL GRAPH

On social web, a user interacts with other people who may or may not be related to him outside the virtual web construct. These people may be friends, family, co-workers, or any number of other logical groupings. Social links to people we know are referred to as direct relationships [6].

A social graph allows websites to draw information about more objects than simply people, including photos, events, and pages, and their relationships between each other. This expands the social graph concept to more than just relationships between individuals and instead applies it to virtual non-human objects between individuals, as well. Social graph in which each person is represented by a dot called node and the friendship relationship is represented by a line called edge [6].

Direct relationships contain the highest degree of social relevance to a user, which means that targeting them is more likely to produce successful returns. As we branch further away from the root user (e.g., friends of the user's friends); we enter the realm of indirect relationship. These relationships map back to the root user through another user. Indirect links still provide some social relevance since they have a common association, but that relevance is greatly diminished compared to that of a direct relationship [6].

All relationships can be categorized in relevance tiers. A direct relationship is the first tier, providing the greatest social link. A first-level indirect relationship is the second tier, as shown in fig. 1.

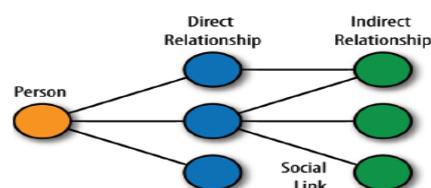


Fig. 1 A Social Grouping and Links

A social graph is a diagram that illustrates interconnections among people, groups and organizations in a social network. The term refers to both the social network itself and a diagram representing the network.

### III. FOAF AND SEMANTIC WEB

Semantic network is a group of entities, which are connected through their relationships. Semantic networks offer valuable information, for instance, individuals' trustworthiness and extraction of people's relation. The semantic web and its respective technologies such as ontologies and vocabularies introduce methods for better data representation and allow machines to automatically originate data from the web [7]

The FOAF Vocabulary definitions presented in this paper are written using a computer language (RDF/OWL) that makes it easy for software to process some basic facts about the terms in the FOAF vocabulary, and consequently about the things described in FOAF documents.

#### A. FOAF ONTOLOGY

The distributed nature of FOAF networks means that FOAF requires a mechanism to link individual profiles and thus allow the discovery of related profiles. Related profiles can be thus discovered by crawling the FOAF network along these links.

The FOAF ontology describes two areas of digital identity information: biographical information and social network information.

#### B. FOAF Classes and Properties

In FOAF description, there are only certain kinds of things and links, which are called properties. The types of things we talk about in FOAF are called classes. These classes and properties describe characteristics of people and social groups that are independent of time and technology [8] as shown in fig. 2. FOAF descriptions are themselves published as linked documents in the web (using RDF/XML or RDF syntax) [9].

<b>FOAF Basics</b> <ul style="list-style-type: none"> <li>Agent</li> <li>Person</li> <li>name</li> <li>nick</li> <li>title</li> <li>homepage</li> <li>mbox</li> <li>mbox_sha1sum</li> <li>img</li> <li>depiction (depicts)</li> <li>surname</li> <li>family_name</li> <li>givenname</li> <li>firstName</li> </ul>	<b>Personal Info</b> <ul style="list-style-type: none"> <li>weblog</li> <li>knows</li> <li>interest</li> <li>currentProject</li> <li>pastProject</li> <li>plan</li> <li>based_near</li> <li>workplaceHomepage</li> <li>workInfoHomepage</li> <li>schoolHomepage</li> <li>topic_interest</li> <li>publications</li> <li>geekcode</li> <li>myersBriggs</li> <li>dnaChecksum</li> </ul>	<b>Online Accounts / IM</b> <ul style="list-style-type: none"> <li>OnlineAccount</li> <li>OnlineChatAccount</li> <li>OnlineEcommerceAccount</li> <li>OnlineGamingAccount</li> <li>holdsAccount</li> <li>accountServiceHomepage</li> <li>accountName</li> <li>icqChatID</li> <li>msnChatID</li> <li>aimChatID</li> <li>jabberID</li> <li>yahooChatID</li> </ul>
<b>Projects and Groups</b> <ul style="list-style-type: none"> <li>Project</li> <li>Organization</li> <li>Group</li> <li>member</li> <li>membershipClass</li> <li>fundedBy</li> <li>theme</li> </ul>	<b>Documents and Images</b> <ul style="list-style-type: none"> <li>Document</li> <li>Image</li> <li>PersonalProfileDocument</li> <li>topic (page)</li> <li>primaryTopic</li> <li>tipjar</li> <li>sha1</li> <li>made (maker)</li> <li>thumbnail</li> <li>logo</li> </ul>	

Fig. 2 FOAF Terms in Categories.

#### C. Syntax And Semantics

Biographical information is assigned to the person using properties for name, gender, family name, home page and date of birth of the person. Example 1 provides a representation of the foaf: person with the name attribute [8].

```
<foaf: person rdf: about="#me" xmlns:foaf="http://xmlns.com/foaf/0.1/">
  <foaf: name>Antonio Jorge</foaf: name>
</foaf: person>
```

Example 1: The FOAF: Person with Name Attribute

Relationships between people are expressed using foaf: knows property [10]. This property defines one person knowing another person in the most general sense of the term. In Example 2 we provide a representation of the foaf: person with name and knows attributes.

```
<foaf: person rdf: about="#me" xmlns:foaf="http://xmlns.com/foaf/0.1/">
  <foaf: name>Sara Ali</foaf: name>
  <foaf: knows>
    <foaf: person>
      <foaf: name>Arslan Ahmed</foaf: name>
    </foaf: person>
  </foaf: knows>
</foaf: person>
```

Example 2: The FOAF: Person with Name and Knows Attributes.

### IV. SYSTEM LAYOUT

The developed system is an academic social network providing services to several universities to collaborate and share knowledge on campus activity. The proposed system is composed of six main modules: tools & services, actor profile, relation & policy, social graph, application platform and semantic web as shown in Fig. 3.

The main language used to implement these modules is the scripting PHP integrated with HTML.

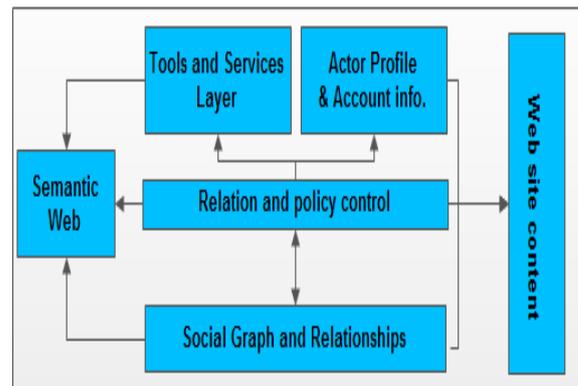


Fig. 3 Academic Social Network Architecture.

When a user accesses the site for the first time, he/she must create an account before using any of the site features. The account creation process is broken into two sections. The first section deals with the login information and is required for the user to fill out such information as (first name, lastName, password and email). The second section deals with information about the user's likes, such as interests, activities, location, and academic info.

### A. Actor Profile and Account Information

This module refers to the users profiles of the academic social network users and their information which includes:

- Profile information  
It comprises biographical information assigned to the user as:
  1. FirstName
  2. LastName
  3. Country, city
  4. Profile picture
- Work place information  
The user must provide the information concerning the university, college, department and Institute or any other education organizations he is registered in.
- Academic information  
This includes academic data specific to the user:
  1. Awarded Degrees
  2. General specialization
  3. Specific specialization
  4. Current project
  5. User interest
  6. academic degree
- Contact information  
This includes contact information of the user as phone, e-mail...etc.

### B. Tools and Services

This module comprises methods for users to contact, interact, and activities with other users. Some examples are messaging (instant message and board message), academic blogging, academic wiki, comment, share files, journals, and write post.

### C. Relation and Policy Control

This module contains all policy services and security measure applied in the academic social network. It describes the type of relationships that user can establish with each other. The privacy options in the developed system provide three levels of privacy: open, friends only, and closed. A feature with an open privacy level is public and may be viewed by anyone by contrast. A feature with a closed privacy level is completely private and can only be viewed by the account owner. A feature with friends only can be viewed by the account owner and his friends.

### D. Social Graph and Relationship

It is a structure used to represent social network. The social graph of the developed academic social network is denoted by the following type of friendship relationships:

- teacher ↔ teacher
- teacher ↔ student
- student ↔ teacher

### V. DESCRIPTION OF USERS USING SEMANTIC WEB

Based on the previously mentioned considerations, each registered user will create a file of friends of a friend based on the information that the user has provided in addition to the information update by the user. The RDF would be generated using FOAF ontology. The user's personal information is described using FOAF, detailing his/her ID, name, family name, nickname, gender, image, location, phone, homepage, mbox, interest, primary topic, top interest, current project and knows. This is illustrated in Fig. 4. Example 3 illustrates a user.RDF file.

The most important feature offered for the user is being able to add and remove friends as depicted in Fig. 5. In the developed Social Networking site, making friends is a fairly straightforward process Users can type in the name of a friend in the search bar at the top of their home page. The database is queried for an account that has the search term contained in the full name, any media with the search terms in the description, any pages with the search terms in the titles, any links with the search terms in the titles, and any notes with the search terms in the title. For example, user A could search for user B in the search bar after clicking on user B's profile. User A will see a button that says Send Friend Request. Clicking on it will send an alert to user B that user A wants to be a friend. The friend request will now be in the friends list of user B, where he/she can either accept it or ignore it.

```
<foaf: person rdf: ID="me">
<foaf: openid>2</foaf: openid>
<foaf: name>Sara Ali </foaf: name>
<foaf: givenname>Sara</foaf: givenname>
<foaf: family_name>Ali</foaf: family_name>
<foaf: nick>sara1</foaf: nick>
<foaf: gender> female </foaf: gender>
<foaf: img>./userdata/sara/t2RE1AoUqSX4Od8/001.jpg</foaf:img>
<foaf: based_near>Baghdad, Iraq</foaf: based_near>
<foaf: phone>+694 -771513732</foaf: phone>
<foaf: homepage> homepage of Sara </foaf: homepage>
<foaf:mbox>sara@mail.com</foaf:mbox>
<foaf: interest> interest of Sara </foaf: interest>
<foaf: primaryTopic>primary topic for Sara </foaf: primaryTopic>
<foaf: topinterest> topic interest to Sara </foaf: topinterest>
<foaf: currentproject> current project of Sara </foaf: currentproject>
```

```
<foaf: knows>
<foaf: Person rdf: about="#1">
<foaf: name>Ahmed</foaf: name>
</foaf: Person>
</foaf: knows>
```

```
<foaf: knows>
<foaf: person rdf: about="#4">
<foaf: name>Yousif</foaf: name>
</foaf: Person>
</foaf: knows>
```

```
</foaf: Person>
```

**Example 3:** The FOAF: Person of User.RDF Attributes

- Using Foaf Openid -- open id to define the ID of the person.
- Using Foaf Name -- name to define the name of that person.
- Using Foaf Family Name-- family\_name to define the family name of the person.

- Using Foaf Nick-- nick to define the nick name of the person.
- Using Foaf Knows -- knows to define that one person knows another.
- Using Foaf Gender -- gender to define the gender of person.
- Using Foaf Image -- associate a picture with a person (or any other FOAF resource).
- Using Based Near -- relate things to locations.
- Using Foaf Phone -- phone to define the phone of person.
- Using Foaf Homepage -- homepage to define the homepage of person.
- Using Foaf Mbox -- mbox to define the mail of person.
- Using Foaf Interest -- interest to define the interest of person.
- Using Foaf Primary topic -- primary topic to define the primary topic of person.
- Top interest -- top interest to define the top interest of person.
- Using Foaf Current project -- current project to define the current project of person.

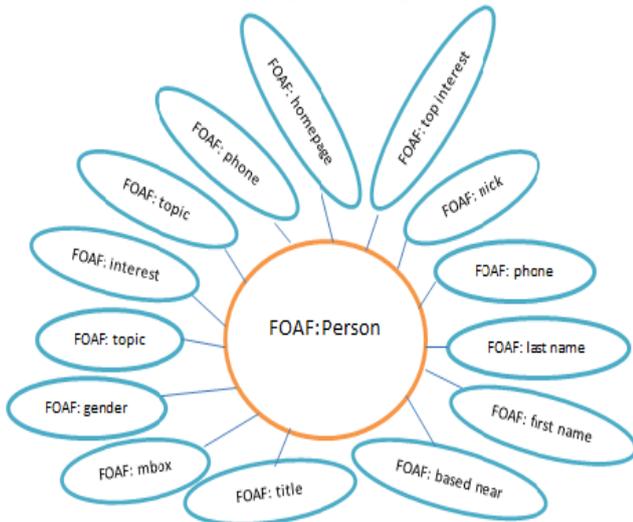


Fig. 4 FOAF Graph to User File

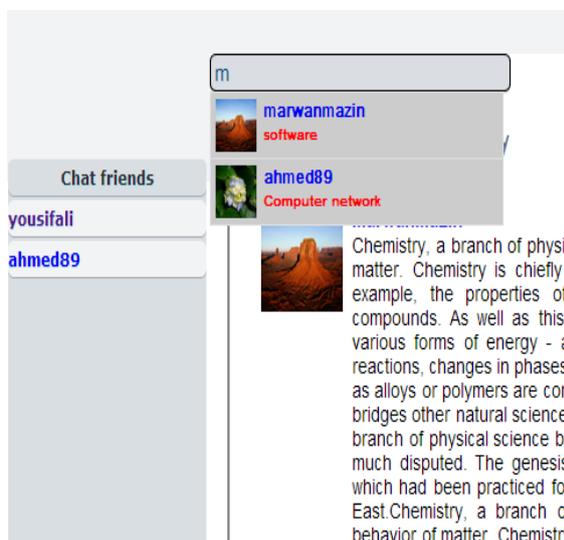


Fig. 5 Users Search Bar.

## VI. MAPPING SOCIAL GRAPH USING FOAF

Generating social graph from social web platforms describes digital identity information in a machine-readable format.

Fig. 6 shows an example of a simple social graph to a user that is called Sara. Sara has two friends Ahmed and Yousif. They also have for each one of them RDF files that have biographical information. We can use their RDF files to get their friends by using any library programming language in project.

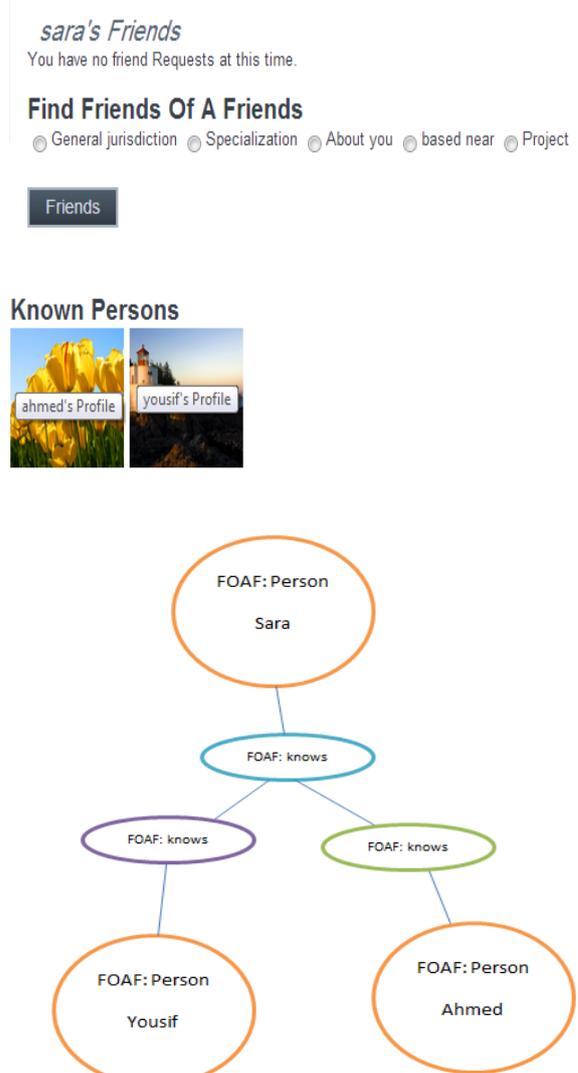


Fig. 6 Friends of A User.

The user can search for friends. He/she chooses one of the following concerns: position, scientific and academic disciplines, personal interests or project work.

As shown in the Fig. 7. The developed application reads the files of FOAF to the user's friends and retrieves information from this file which include (the current project, academic disciplines university and research interest). Depending on this information the user can specify the search friends, find friends based on mutual interests of academic fields. That is the searching process is carried on by using FOAF files without need to return to the database, which supports decentralization the search application.

### Find Friends Of A Friends

General jurisdiction Specialization About you based near Project

Friends



Fig. 7 Friend's Suggestion to User Based on Project Interest Selection

For example, user A is a friend of B and B is a friend of C. If user A is looking for friends based on common interest, for next clicking on friend button, the application will suggest user C as friend to A based on mutual interests as shown in Fig. 8.

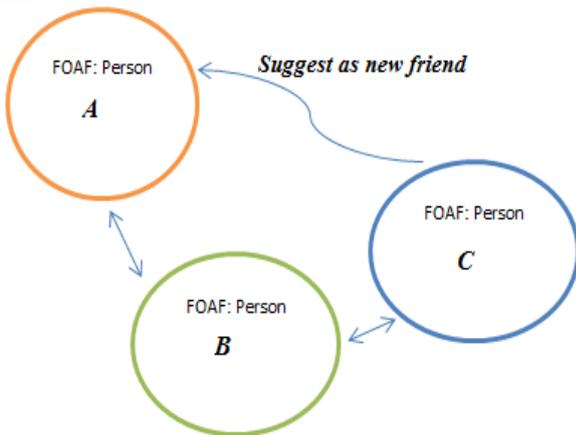


Figure 8 Friends Proposed.

As shown in the Fig. 9, in the search process depends on the number of friends per user. To increased opportunities of to getting new friends having the same academic interests, the search process can cross the stage of friends of a friend, and attempts access to

- Your friends' friends
- Your friends' friends' friends

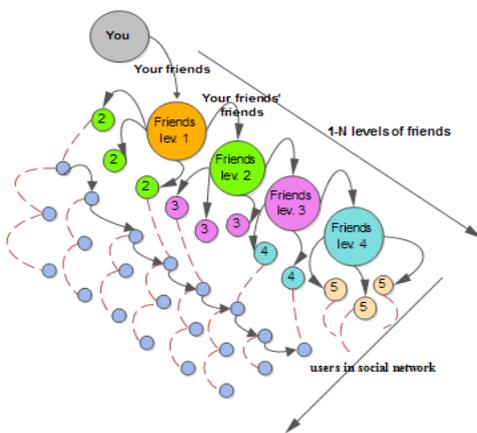


Fig. 9 FOAF Searching Architecture Based on N-Levels.

The research process in this way will help to set up virtual groups within the social graph depending mainly on shared interests, which assists to build a social network of academic institutions as it serves allows the user to add friends depending on common research interests, which manifests the positive results for neat and advantageous cooperation between academic users.

### VII. CONCLUSIONS

The conclusion of this work could be summarized as follows:

- When a social network publishes information in FOAF document format about their users, machines will be able to make use of that information to search and find friends of a friend without need to access the database.
- FOAF is a better way of keeping track of the scattered fragments of data currently represented in the Web.
- FOAF files are used by semantic web to describe people and the relationship between people in way that makes it understandable and automatically processable.
- A FOAF file facilitates the process to find information about people based on their publications, employment details, group membership and declared interests.
- The developed application focuses on semantic web that has been integrated within account management component to enhance the intelligence of web-based information system.

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