

Building MedWeight Smart Community using Social Networking Technology

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Abstract—Social networks have been established as a prominent model for communication and interaction between individuals, as well as among members of communities or organizations. However, as the need to support on-line vibrant communities constituting of different individuals, having different roles, privileges and capabilities, is constantly increasing, alternatives to the typical social network model should be explored. Smart communities could be effectively supported by social network technology, though specific issues should be explored to efficiently model community member behavior as they interact in the real-world. In the paper, we focus on MedWeight smart community, built to support volunteers trying to maintain weight loss. It enables them to be members of a community composed by both other volunteers and nutrition experts, taking into consideration the way support groups are formed in the real-world. To support Medweight smart community, a corresponding social network platform was built, extending the typical social network model to support roles, relations and complex content dissemination policies.

I. INTRODUCTION

Information and Communication Technology (ICT) is literally changing every aspect of our life [1]. This entire new age has affected a great number of different domains providing new widely accepted tools and visions for everyday communication and collaboration among participants. A great impact on this growing area has been accomplished from on-line social networks, as they have been established as a prominent model for communication and interaction between individuals, as well as among members of communities or organizations. There is no questioning of on-line social network success, as social networks have been popular since the beginning of civilization [2].

Despite the human social nature, the concepts of community development and community participation took shape in the 1950s [3]. Nowadays, it is assumed that citizen participation is a desired and necessary part of community development activities. Participation means that people are closely involved in the processes that affect their lives. As mentioned in [4] citizen's participation is the process that can meaningfully tie programs to people. Furthermore, sense of community is a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members needs will be met through their

commitment to be together [5]. In conclusion, there is no doubt that participation of community members is the main pillar in any modern community development program [6].

Communities around the world are responding to the participants needs by discovering new ways of using information and communication technologies (ICT) for economic, social and cultural development [1] establishing a new concept called "Smart Communities". In Smart Communities Guidebook, developed by California Institute for Smart Communities (1997) at San Diego State University the concept of Smart Community is presented as a community in which government, business and residents understand the potential of information technology, and make a conscious decision to use that technology to transform life and work in their region in significant and positive ways [7]. In present, the Smart Community concept is known and used all over the world under different names and in different circumstances [1]. In any case, it is considered an imperative constituent of the smart city environment. Could modern social network technology serve the concept of smart communities? May current popular social networks promote the creation and support of smart communities? Are there any limitation in social network interaction model hindering smart community support?

These are the questions we are dealing with in this paper in our effort to promote a smart community targeting weight maintenance support, called MedWeight. Social network technology was employed to support MedWeight community. In the paper, we also propose to extend the typical social network interaction model [8] to explore smart community requirements imposed on social network technology. Based on the proposed extended interaction model, a social networking site was developed aiming to support this specific community of volunteers for weight maintenance using professional dietitian advice.

The rest of the paper is organized as follows. The motivation for this work is explained in section II. Section III outlines some key challenges in supporting MedWeight smart community and corresponding extensions proposed to the social network model. MedWeight social network, developed to support the community is presented in section IV. Conclusions and future work reside in section V.

II. MOTIVATION

It is a common truth that the Internet and Web technologies have helped many of us communicate more easily and effectively. Web 2.0 applications and platforms, such as wikis, blogs and social networks, enable people to communicate directly and without space or time limitations. Although social technology does not affect the interdependency between people, it strongly enhances the probability that people who are interdependent, in the sense that they could share common interests, learn about each other and eventually start a relationship. In any case, enhancing accessibility may have a positive impact in maintaining, enriching and building communities [9]. Thus, social technology may definitely contribute in promoting the Smart Community concept. Social support, as perceived in the context of smart communities, is defined as the resources or aids exchanged between individuals through interpersonal ties [10]. This is one of the key benefits that users perceive from on-line social networking [11].

As indicated in [12] Social Network users perceived a greater level of emotional support and companionship than did general Internet users at a level that was almost equivalent to the amount that married or cohabiting Americans normally perceive from their live-in partners. The same view appeared in [13] where the results shown that the positive affect felt by social network users after on-line social networking was positively associated with perceived companionship support, appraisal support, and life satisfaction. In the same study [13] was noticed that it is the quality of interaction that matters in establishing social support and psychological well-being, but not the frequency or amount of social networking use. The proliferation of the Internet for acquiring information on health and developing e-health has gained a lot of attention in recent years [14]. Social technology has empowered patients to share their information and experiences and also to gain access to others information [15]. According to [16] the key factors of on-line health support communities high popularity are:

- any time support overcoming time boundaries
- anywhere support overcoming distance boundaries that might be associated with traditional face-to-face support provision
- establishment of "safe" environment for individuals with stigmatizing or disfiguring conditions to obtain support
- anonymization makes it easier for individuals to discuss sensitive or embarrassing topics, and may increase honesty, intimacy and self-disclosure
- larger broad of experiences and opinions may be offered than face-to-face support groups

The majority of existing social health-related applications are targeting on-line health care and support communities. They consist mainly of medical blogs and micro-blogs [17], wikis [18] and media sharing sites [19]. Social networking sites are also available [20]. Social technology may also bring a new dimension to health care as it offers a medium to be used by the public, patients, and health professionals to communicate about health issues with the possibility of

potentially improving health outcomes[21]. There are several examples of social media applications targeting evaluation and reporting of real-time diseases, catalyzing outreach during (public) health campaigns and recruitment of patients to on-line studies and in clinical trials [22].

Concerning weight management, cross-sectional, cohort and intervention studies have demonstrated that social support facilitates initial weight loss and weight loss maintenance [23]. However, what is the impact of technology? Could social technology contribute to establish a smart community helping its member in their effort to lose weight and maintain weight loss [24]? Who should be part of this community? Should weight management experts also participate to provide professional advice or should the community only persist of people interested in weight management?

As indicated in [23], the contribution of social technology seems helpful, since the participants of the study were almost five times more likely to perceive Encouragement support for their weight loss efforts if they used the social media tools at least once a week. In addition, this study [25] showed that an Internet weight maintenance program could sustain comparable long-term weight loss compared with a similar program conducted in person and over the phone. On the opposite side, in [26], the arm with social media demonstrated no difference in perceived support compared to in-person therapy and it also had the highest rates of attrition.

To this end, in the following we explore the potential of using social networking technology to build a smart community for weight management. As such, the community should explore all available technology to help its members serve their purpose. As in face-to-face support groups, the community should consist of people interesting in maintaining their weight and experts helping them. In contrast to what is normally the case in existing social networks, where all participants are treated as equal and have exactly the same capabilities and rights, in this smart community environment participants should be able to differentiate their behavior in the community based on their role, as in the real world, when attending a support group for example.

III. MEDWEIGHT SMART COMMUNITY

The MedWeight Smart Community was established as part of a research study related to weight maintenance by the Department of Nutrition and Dietetics at Harokopio University of Athens (<http://medweight.hua.gr/en/index.php>) two years ago. MedWeight Smart Community consists of more than 1000 volunteers involved in the study and Nutrition experts and researchers, advising them. The main objective of MedWeight community is to help volunteers maintain their weight and follow-up people encountering weight problems. Both other volunteers and nutrition experts are assisting them in this effort. Volunteers include both successful losers and weight loss regainers. Their interaction may be of interest, as the assistance they provide to each other is achieved mainly through communication between them. Helpful information and guidance by the nutrition experts related to issues of interest in MedWeight community is also provided to volunteers. The prospect of participant's mutual support for health issues through direct communication, was the main motivation for establishing

MedWeight community. The main feature differentiating it from other similar efforts on Health issues, is the fact that both volunteers and nutrition experts participate in the community, having different roles and capabilities as in real life. In existing communities either patients or doctors participate, having exactly the same privileges and capabilities (as for example <https://www.patientslikeme.com> for patients or <http://twitterdoctors.net> for medical professionals). Such a feature enables the volunteers to behave in on-line Medweight community as they would a real-world support community, receiving similar services and perceiving their support community the same way as they would in the real-world. Thus, Medweight obtains the characteristics of a true smart community, as prescribed in [7].

A. Extending Social Networking model for Medweight Smart Community

The typical social network model, as supported by popular social networks, such as Facebook, Twitter and Google+, dictates that all participants are a) described by the same characteristics, b) belong in the same category and c) are related to others with one unique relation type (e.g. friendship in Facebook or Follower in Twitter). Available social networking platforms do not support the participant's discrimination in different types, being unable to disseminate the produced information according to their category. Also, participant profile for all users should have the same properties, obstructing the opportunity of saving particular data to user profile based on users category. Moreover, one specific relation type is supported. Even in cases like Google+, where participants have the ability to build cycles, indicating different types of relations between their friend, such a feature enables grouping and not different relation types, since the relation characteristics still remain the same, independently of people involved in it.

In the following, we propose to extend the typical social network interaction model [8] to explore the aforementioned requirements imposed by Medweight smart community [27]. Based on the proposed extended interaction model, a social networking site was developed aiming to support this specific community. Our vision is that our proposed model and social networking site could be used from other communities as well.

These are the main characteristics added to the typical social network model:

- Role definition support to reflect the role each participant plays in the community
- Relation definition support to reflect the different relation developed between of community members having different roles
- Information dissemination advancement based on roles and relations
- Group management advancement based on roles and relations
- Application execution based on roles and relations

The proposed extensions are summarized in Fig. 1 and analytically discussed in the following. In the figure, proposed entities are depicted as cyan rectangles.

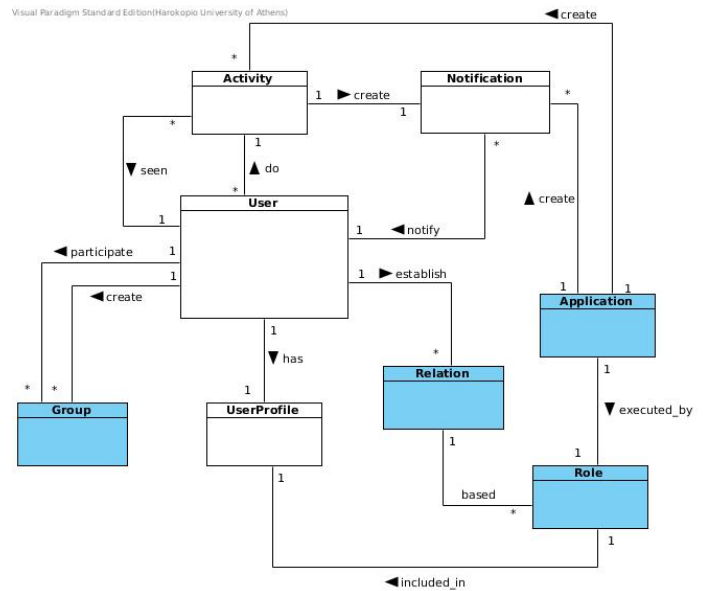


Fig. 1: Extended Social Network Model

1) *Participant Roles*: Realizing that there was a major need to differentiate between participants to reflect their role and capabilities/ responsibilities in the community, the concept of Role was introduced. It enables to manage information dissemination among participants, indicate responsibilities and enables different ways of describing participants (for example the profile data of a Nutrition Expert may vary from those belonging to a volunteer).

Capitalizing this concept, one can easily recognize the members of a specific role. Moreover, roles can be used to either assign permitted actions to participants bearing a specific role or indicate the role a participant should have in order to be able to execute specific action.

2) *Relations between Participants*: Establishing relations with others is one of the main options given to social network participants. There are two general types of relations : mutual (bidirectional) and one-way (unidirectional) [28]. Our proposed model could support the dynamic creation of relations of both types between participants, based on the predefined user roles. Relations can be either unidirectional, indicating that a community member receives information from another member, or bidirectional, indicating that the members interact. When a relation exists, the object of the relation receives updates, posts and material published to the corresponding stream of the subject member profile, and benefits from specific activities provided by them.

3) *Information Dissemination*: The most common operation that a participant performs in a social network is publishing content, which can be of a variety of types, such as links, texts, files, multimedia etc. Published information is propagated in the form of a stream to all participants related to the publishing entity, who receive notifications and updates about the publication, urging them to review it and possibly contribute to it, as dictated by the notion of collaborative content in Web 2.0 [29].

In communities, specific streams should be defined based

on participant roles and relations. Apart from the member relations, the social aspect of the community should not be dismissed; therefore, each member may develop a social relation with any other member of the community, regardless of their roles in it. At the same time, a clear separation between them should be maintained, thus a more complex propagation mechanism is introduced incorporating more than one discrete streams. Along with streams, the proposed model also defines propagation rules indicating which participants receive the publications directed to each stream. While the publisher maintains a unified stream on the corresponding profile, the propagation of published information does not take place for all publishers contacts indiscriminately, but is based on the type of their relation with the publisher, determining the stream they receive. The combination of discrete participant roles, multiple streams, extended relations and rules governing the propagation of content successfully achieves the separation between information shared between community members.

4) *Groups*: The combination of roles, relations and streams does not fully facilitate fine-grained content propagation; therefore, a more elaborate mechanism for content delivery is proposed, through groups. Groups are arbitrary sets of contacts that any social network member can create and modify dynamically. Each group has a specific name, and the member who creates it, as its owner, has control over membership of other participants, which may join or leave the group. All members and only the members of a group can publish content in the group, while the owner maintains control over all posts. Each publication to a certain group belongs to a corresponding custom, ad-hoc group stream and is propagated to all members of this group.

5) *Application Execution*: Collaboration in a typical social network is performed through exchange of information and notifications in a distributed fashion [30]. In addition to sharing content and notifications through discrete streams and groups, the proposed social network model supports the provision of specific activities and enables its participants to complete specific actions in collaboration with other participants. Actions may be provided by cooperating applications executed in a specific participant profile. Typical social networks enable applications to be executed on the participant profile. These applications usually read data from the participant profile and may invoke external applications through a web service interface. They also have access to store data in the participant profile. In order to ask for services rather than information from another participant, a more sophisticated communication mechanism is required, facilitating information exchange between applications executed on different participant profiles.

B. Medweight Social Network

The MedWeight Social Network was built, based on the extended social network model, to support Medweight Smart Community. It is currently deployed using Python and Django web application framework (<https://www.djangoproject.com>), while the user interface, in this phase, supports only the Greek language.

There are two distinct roles and two relations supported in MedWeight community:

- Volunteer: a person who takes part in the study and wants to benefit from MedWeight community to main-

tain weight. Most likely volunteers have been in a diet and would benefit from expert advice to maintain their weight

- Dietitian: an expert scientist that provides advice, services and feedback to participants of the role Volunteer.
- Consultant Relation: a unidirectional relation from a volunteer to a dietitian, which enables volunteers to use dietitians to obtain expert advice
- Fellow Relation: a bidirectional relation which can be defined between volunteers, which enables them to share experiences and information related to Med-Weight community.

Roles and relations are defined through MedWeight administration platform, as depicted in Fig. 2. 2).

The screenshot shows the 'Add Relationship status' form in the MedWeight Administration Interface. The form has several input fields and checkboxes. On the right side, there is a 'MedWeight Roles' sidebar with three radio button options: 'Role', 'Dietitian', and 'Volunteer'. The 'Dietitian' option is currently selected. Below the sidebar, there are two checkboxes: 'Login required' and 'Private', both of which are currently unchecked.

Fig. 2: Defining Roles using MedWeight Administration Interface

The volunteer Home Page in MedWeight social network is shown in Fig. 3. Participants may easily post content and declare its visibility, establish relations with other participants, create/manage groups and execute applications, as discussed in the following.

The interaction between Medweight participants is performed mainly by publishing content either in their profile or in interest groups that can be created. Groups created and managed by Dietitians are treated differently than groups created by volunteers, as in those groups "expert" opinions are posted. Only dietitians, authorized by the creator of the group, post content in it.

The content that is published by Medweight community members in their profile, is shown to all other community members related to them, either by consultant or fellow relation. In order to succeed the optimal dissemination of information, there are several given options to users related to 'visibility' of the publication such as private, public, visible to a specific participant, visible to all of them, e.t.c.

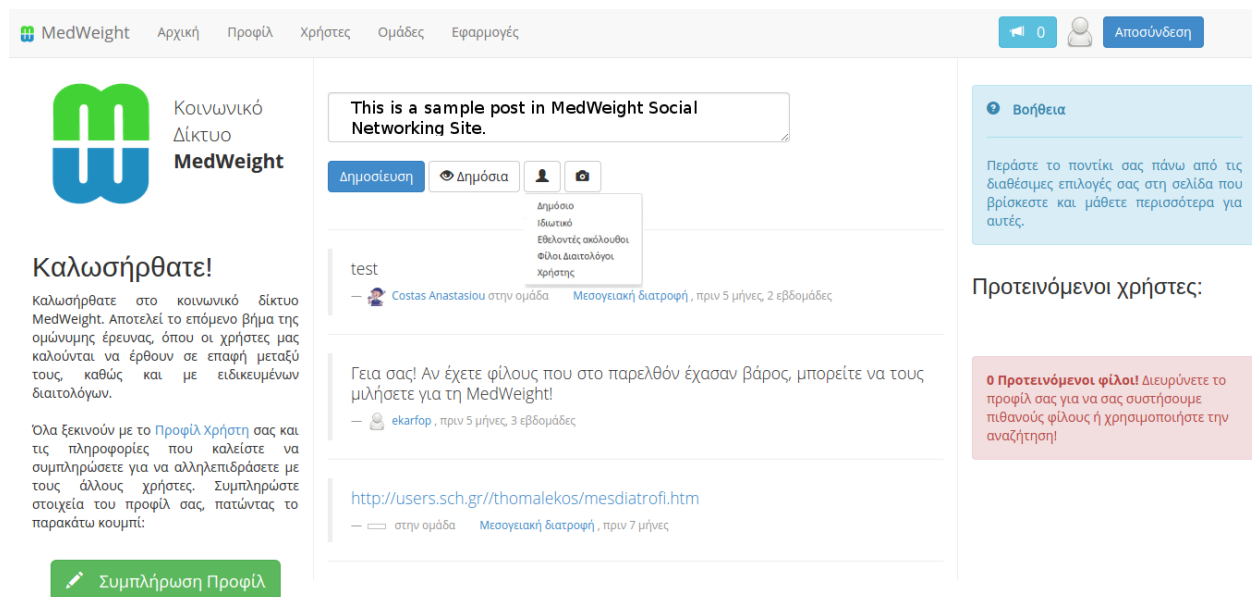


Fig. 3: MedWeight Participant Profile View

Through the corresponding option in the right, bottom part of Fig. 3 (red rectangle), a recommendation mechanism was designed in order to match volunteers with similarities in order to promote their interaction. This process pursues to detect other volunteers with same info in their profile. Volunteers may search members of the community based on specific criteria they may combine, as shown in Fig. 4.

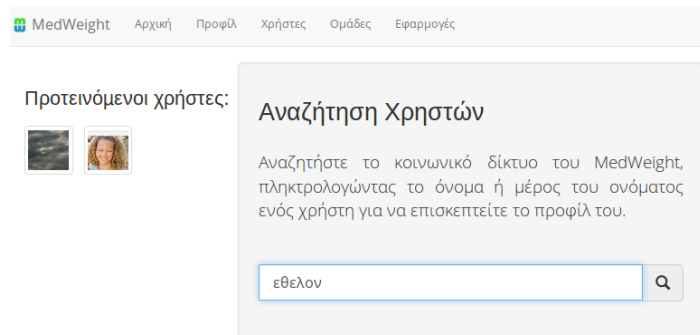


Fig. 4: Volunteer/Dietitian Recommendation Mechanism

Applications may also be executed with MedWeight Social Network platform. As an example, the weight maintenance application is briefly presented. Volunteers may daily register measurements of their weight, running such an application in their profile (Fig. 5). With each measurement, the application calculates certain dietetic factors, such as Body Mass Indicator. If any of these factors have exceeded a certain limit, a notification is issued to dietitians chosen by the volunteers as their instructors. Consequently, the dietitian can provide personalized feedback and expert advice to the volunteer, properly directing the proper content to him/her.

MedWeight Social Network is currently operating on a prototype environment, while the first results on its usage will

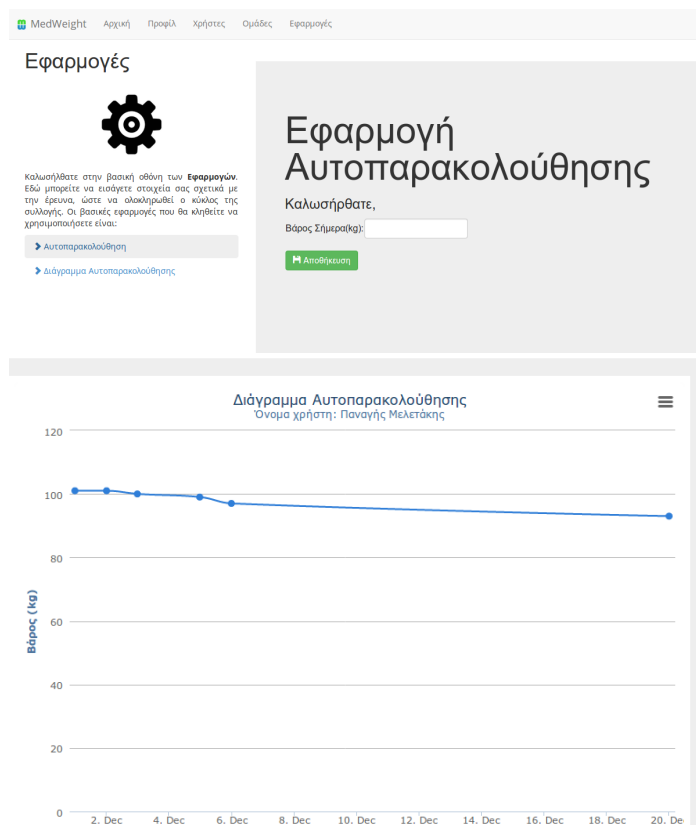


Fig. 5: Weight Maintenance Monitoring Application

be available next year, after completing 12 months of usage.

IV. CONCLUSION

MedWeight on-line community was build to support volunteers trying to maintain weight loss by allowing them to be members of a community composed by both other volunteers and nutrition experts, taking into consideration the way support groups are formed in the real-world. It is considered to be a smart community and treated as such, since its purpose is to utilize all available technology to maintain and promote the characteristics of real-world communities. To support Medweight smart community, a corresponding social network platform was built, extending the typical social network model to support roles, relations and complex content dissemination policies. MedWeight Social Network is currently under testing by the community, while the first results on its potential impact will be available after completing 12 months of usage.

Future work includes the extension of MedWeight Social Network to provide a variety of applications allowing participants to use external services and the application of the proposed extended social network model to support other communities as well.

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