SocialWiki: Bring Order to Wiki Systems with Social Context

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Abstract. A huge amount of administrative effort is required for large wiki systems to produce and maintain high quality pages with existing naive access control policies. This paper introduces SocialWiki, a prototype wiki system which leverages the power of social networks to automatically manage reputation and trust for wiki users based on the content they contribute and the ratings they receive. SocialWiki also utilizes interests to facilitate collaborative editing. Although a wiki page is visible to everyone, it can only be edited by a group of users who share similar interests and have a certain level of trust with each other. The editing privilege is circulated among these users to prevent/reduce vandalisms and spams, and to encourage user participation by adding social context to the revision process of a wiki page. By presenting the design and implementation of this proof-of-concept system, we show that social context can be used to build an efficient, self-adaptive and robust collaborative editing system.

Keywords: wiki, collaborative editing, social context modeling, trust management, social network applications

1 Introduction

Wiki systems are widely used since they allow multiple contributors to create and edit a set of documents collaboratively, such as manuals, design documents, and knowledge bases. Among the numerous wiki systems, Wikipedia is probably the best known. With three million articles (in English) and over 150K users contributing to Wikipedia (as of April 2010 [1]), it is challenging for administrators to insure the quality of all these pages and edits, especially when dealing with vandalism and unreliable edits. Notable examples include content creation to disrupt the neutrality of a page, hiding and suppression of facts, malicious advertisement placement, and referral to other websites to boost search

[1] http://en.wikipedia.org/wiki/Wikipedia

engine rankings. Access control has been adopted to alleviate the review workload for editors and administrators, but it does not scale with large systems such as Wikipedia. This paper presents a prototype system, SocialWiki, which has built-in reputation and trust management to set edit privileges for each article automatically using social context. The previous contributions from individuals as well as the ratings they have received from others are used to determine who is a good candidate for editing a particular article.

Furthermore, after an article is created, it may take a while before this page is revised by another editor. The absence of active contributor selection slows improvement of document quality and fails to engage the interest of potential contributors. According to the Wall Street Journal [2], in the first quarter of 2009, the English-language Wikipedia had a net loss of more than 49,000 editors, compared to a net loss of 4,900 during the same period a year earlier, despite that the number of Wikipedia visitors grew 20% from Sep. 2008 to Sep. 2009.

SocialWiki allows users to specify what kinds of pages they would like to review/revise and actively finds potential contributors for new pages. This recommendation process is achieved with the help of social context. More specifically, SocialWiki clusters users into communities with shared common interests and then employs trust management and review recommendation to help these communities grow and boost collaborations among users. The trust model is initialized by the social network of wiki users, which can be any existing social network, such as Facebook, and refined as users rate the editing of each other.

To reduce vandalisms and spams, SocialWiki restricts the edit access of a wiki article with *editing certificates* (EC). A user can only edit an article when he/she has an EC of this article. According to specific application scenarios, the maximum number of EC which an article is allowed to have can be set by the system or customized by the article creator. In this paper, one EC for each article is chosen to simplify our discussion. After a user finishes editing, the EC will be circulated by the system to another user according to interests and trust. More specifically, SocialWiki assigns an EC with high probability to users who are interested in editing this article and are trusted by other users. To keep users from holding EC forever without contributing, SocialWiki circulates ECs to other users after a certain period of time. SocialWiki not only finds contributors to improve the quality of pages but also encourages social interactions between them. The communities established through collaborations can be used to work on things other than wiki editing, such as patent design, paper review, and social bookmaking.

The major contribution of this paper rests on a new wiki model which tackles traditional wiki weaknesses by the following measures:

- Proposing an active contributor selection mechanism for large wiki systems to improve document quality and better engage contributors.
- Building an adaptive and automated trust model into wiki systems to identify good contributors, reducing vandalism and spam.
- Utilizing a user interest model to match documents with relevant contributors.

– Developing a probabilistic EC circulation algorithm to combine interest and trust models.

The rest of this paper is organized as follows. Section 2 introduces the architecture of SocialWiki and presents its key building blocks, user interest, trust model and EC circulation. Section 3 demonstrates how SocialWiki employs user feedback to generate high quality articles and prevent spams. Section 4 presents a prototype implementation of SocialWiki; After reviewing related work in Section 5, the paper concludes with Section 6.

2 The Design of SocialWiki

In SocialWiki, an article is associated with one or more editing certificates (EC). A user can only edit this article when he/she has its EC. After a user submits his/her revision, his/her EC will be transferred to another user by SocialWiki such that interested and trustworthy users can have a better chance to review the changes and revise the document. In this section, we present the architecture of SocialWiki and the social context model used to circulate ECs.

2.1 Architecture

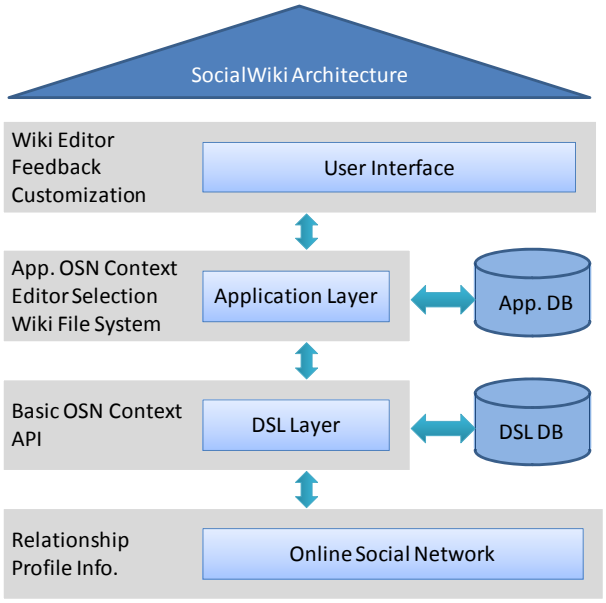

Fig. 1. The Architecture of SocialWiki

Fig. 1 shows the architecture of SocialWiki. The bottom layer of SocialWiki is an existing online social network (OSN). Our prototype chooses `Facebook.com` as its OSN layer.

On top of the OSN layer is the Davis Social Link (DSL) layer [15], which was initially designed to prevent spams by using interest-based trust to control the messages user receive [3]. DSL includes a database and a set of APIs to provide high level applications with basic trust and user interest computed from OSN.

The application layer consists of three components: application social context, editor selection module and wiki system. Application social context obtains general interest and trust information from the DSL layer and generates application-specific interest and trust models. Circulation module probabilistically assigns an EC to interested and trustworthy users according to their social context and the ratings they have received in previous collaborations. All the articles and their revision history are stored in wiki.

Through the user interface, users can customize their social context and provide ratings to other contributors.

The rest of this section focuses on two key components of the application layer, application social context (Section 2.2 and 2.3) and editor selection model (Section 2.4).

2.2 User Interest

Current wiki systems passively wait for users to contribute, adding new pages or improving existing ones. To accelerate this process, SocialWiki actively recommends articles to users based on their interests. The basic idea is that if Alice contributes to an article, the users who share common interests with Alice have a higher probability than a random user to be interested in this article as well. Therefore after Alice submits her changes, her EC will be transfered to one of these users with high probability.

User interest can be either stated explicitly by users or learned automatically from user profiles. Current SocialWiki asks users to provide a set of keywords to represent their interests.

Keyword-based Interest Description Each user u_i maintains a list of keywords ℓ_i which describe his/her interested topics. For example, if u_i is interested in soccer, ℓ_i may contain "soccer" and "FIFA". The synsets provided by WordNet [7] are used to match synonyms. A synset is a set of synonyms which are interchangeable in some context without changing the meaning of the proposition in which they are embedded. For each u_i, his/her keyword list is mapped to a list of WordNet synsets. More specifically, we construct a user interest matrix $V(n, m)$, where n is the number of users and m is the number of all synsets. $V[i][j]$ denotes whether u_i is interested in synset s_j, shown as follows.

$$V[i][j] = \begin{cases} 1, \, u_i \text{ is interested in } s_j \\ 0, \, u_i \text{ is not interested in } s_j \end{cases} \quad (1)$$

Computing User Similarity Another matrix $U(n)$ is used to represent user similarity, where $U[i][j]$ is the Pearson Correlation Coefficient (PCC) of user u_i and u_j [11], and n is the number of users. Formally, given the interest matrix $V(n, m)$, let the $\overline{V[i]}$ and $\overline{V[j]}$ denote the mean of the i^{th} and j^{th} rows of V, respectively, then PCC is defined as (2):

$$U[i][j] = \frac{\text{cov}(V_i, V_j)}{\sigma_i \sigma_j} \tag{2}$$

where $\text{cov}(V_i, V_j)$ is the covariance of V_i and V_j, and σ_i and σ_j are the standard deviation of V_i and V_j.

U is a symmetric matrix as $U[i][j] = U[j][i]$. $U[i][j] \in [-1, 1]$. $U[i][j] > 0$ implies a positive association, i.e., in our application, nonzero values of $V[i]$ tend to be associated with nonzero values of $V[j]$ and zero values of $V[i]$ tend to be associated with zero values of $V[j]$. $U[i][j] < 0$ implies a negative or inverse association, i.e., nonzero values of $V[i]$ tend to be associated with zero values of $V[j]$ and zero values of $V[i]$ tend to be associated with nonzero values of $V[j]$.

2.3 Trust Model

As EC is circulated to interested users, however, malicious users such as vandalists and spammers may target certain topics by marking related keywords as their interests. Meanwhile, among the benign users who are interested in a certain topic, some have more expertise than the others. To reduce vandalisms and spams as well as find high quality contributors, SocialWiki employs a trust protocol to assure reliable collaboration, such as the DSL trust protocol in our prototype. Many OSN trust protocols can be used as well.

DSL Trust Protocol The DSL trust protocol is initially proposed in [15]. It propagates trust along the social network and enables communication between two users if there is a trustworthy social path between them. Here we illustrate how DSL works with a simple example. Interested readers please refer to [15] for details.

Fig. 2. An Example Social Path

DSL helps users find trustworthy social paths between a message sender and a recipient, such as the path Alice→Carol→ Bob in Fig. 2. The decimal value between two directly connected users, ranging from 0 to 1, represents the trust

between them. In this example, even though Alice does not know Bob well (notice that there is no direct social connection between Alice and Bob), she can trust her friend Carol to deliver her message to the right Bob. If Bob dislikes the message forwarded by Carol, Bob can punish the social path between himself and Alice. So the set of trust values along the social path decrease, i.e., Alice has a smaller probability to reach Bob in the future. Thus, as the receiver, Bob can control who can reach him.

The trust relationship is directed, i.e., the trust value from Alice to Carol may be different from the value from Carol to Alice. DSL reflects real world communications, where people can communicate with each other if they can develop a social path between each other.

SocialWiki's EC circulation bears a similar idea behind the DSL trust communication protocol. If Alice is the current EC holder and she likes the article, she would like to circulate the EC to some trustworthy people who have social paths to her. These trusted EC receivers have the right to decide whether this article is interesting to them. If they do not like it, they can punish the trust values along their social paths to Alice, so that next time they have less probability to receive and revise the articles liked by Alice.

SocialWiki Trust Context SocialWiki integrates user interest into the DSL trust protocol.

First, there needs to be a social path between the current EC holder and the next EC holder. Second, all the users in this social path need to be interested in one or more synset related to the article. In addition, these synsets must be within a certain perimeter, because some users may only be willing to share their interests with users close to them in the social graph. SocialWiki allows users to set the perimeter with the following three options.

1. Direct friends, i.e., within one hop;
2. Direct friends + their friends, i.e., within two hops;
3. Entire social network.

Each interest keyword is associated with one of these options.

Let us use Fig. 2 as an example again. Alice currently has the EC for a wiki article that is labeled with three synsets $C = \{s_1, s_2, s_3\}$. The Common Interest Set (CIS) of her, Carol and Bob is $\{\text{Synsets(Alice)} \bigcap \text{Synsets(Carol)} \bigcap \text{Synsets(Bob)}\}$ equal to $\{s_1, s_3\}$, which is not an empty set. Assuming that all the three people define s_1 and s_3 with Option (2) or (3), then this social path is considered as a candidate. If Bob defines s_1 and s_3 with Option (1), this social path is not a candidate.

Among all the candidate social paths, we select one to deliver the EC with the following criteria.

- The trust values along the social path need to exceed a certain threshold.
- The larger the CIS is, the larger probability that the social path will be selected.

2.4 Editing Certificate (EC) Circulation

After a current EC holder submits his/her changes, SocialWiki will transfer his/her EC to another user, thus other users get the chance to review/revise this article. This process is called EC circulation, which tries to push articles to high quality contributors automatically and meanwhile prevent/reduce vandalisms and spams. EC circulation is also triggered when a user holds an EC for a certain period of time without contributing to the article. Fig. 3 illustrates the process of EC circulation.

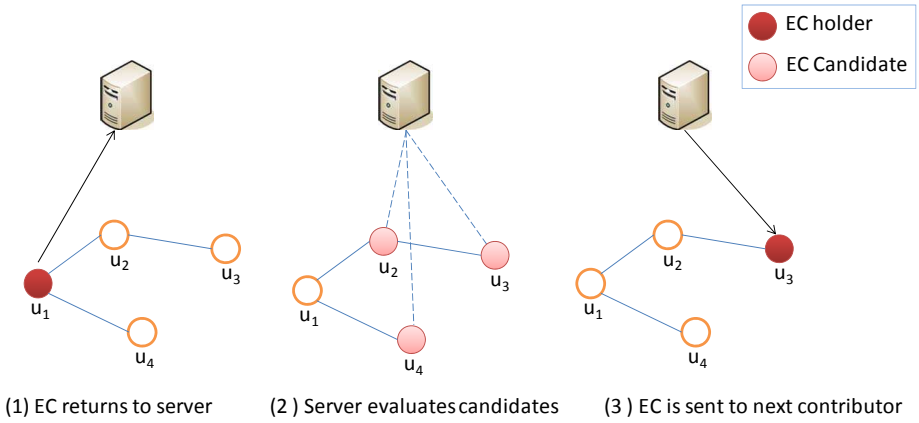

Fig. 3. EC Circulation

To avoid monopoly, SocialWiki employs a probabilistic model to circulate ECs. More specifically, every user will receive an EC with a probability determined by user interests and trust. Established users with larger CIS and trust have a better chance to get the EC but new users also get the opportunity to contribute and build their trust.

Besides user interests and trust, previous collaboration between the current EC holder and the candidate is also taken into account. The intuition behind this is that if two users have collaborated many times before and have affirmed each other's work, they are likely to work together again.

SocialWiki provides a "dislike" option for users who receives the EC due to either language ambiguity or user interest model's poor understanding of semantics. After the current EC holder specifies that he/she dislikes the article, SocialWiki restarts the EC circulation process by returning to the user who created this article, and uses his/her social context to find the next contributor. Therefore, even if poor contributors were chosen previously, we are still able to find good ones by staring the EC circulation all over again.

Formally, given the current EC holder u_i, SocialWiki computes all social paths starting from another user u_j to u_i (recall that in the DSL trust protocol,

the recipient decides if he/she is willing to receive the message instead of the sender selecting which recipient to send the message to). Assume that Q social paths (SP) are found from u_j to u_i. Let $TV[k]$ denote the smallest trust value along the social path $SP[k]$, $cis_{SP}[k]$ denote the CIS (common interest synsets) along $SP[k]$, and syn_{EC} denote the synsets related to the wiki article (as an EC is always tied to an article). Then we compute $TE[i,j]$ as (3):

$$TE[i,j] = \{max_{1 \leq k \leq Q} TV[k]\} \times \frac{|cis_{SP}[k] \bigcap syn_{EC}|}{|syn_{EC}|} \tag{3}$$

In other words, $TE[i,j]$ is the weighted minimum trust value on the most reliable social path from u_j to u_i.

Then Bayesian inference is used to compute the probability that u_j likes an article revised by u_i according to their previous collaborations. Given an article, let $P(i)$ denote the probability that u_i likes the article and $P(i|j)$ be the probability that u_i likes the article given that u_j likes it. If we define related articles as those whose synsets share common words with the given article's synset, $P(i)$ can be calculated by the number of related articles which u_i has received and is interested in. Similarly, $P(i|j)$ is the number of related articles that u_i is interested in, given u_j has received and is interested in these articles. Thus, the probability that u_j likes the article given that u_i likes it can be computed as follows:

$$P(j|i) = \frac{P(i|j) \times P(j)}{P(i)} \tag{4}$$

With the interest similarity matrix, weighted trust, and the likelihood that u_j likes the article, we can compute the priority(RP) that u_j receives EC as follows.

$$RP[i,j] = U[i,j] \times \alpha + TE[i,j] \times \beta + P(j|i) \times \gamma \tag{5}$$

where α, β and γ are weight factors, which can be constants or dynamically adjusted. Current SocialWiki initializes α, β and γ as 0.3, 0.5 and 0.2 respectively, as we believe that trust relationship is the most important. These parameters need to be tuned according to the specific application scenarios, which is beyond the scope of this paper.

Technically the RP given by (5) is not a probability, as it may be larger than 1. Thus we need to normalize it with the sum of the RPs of all u_j, i.e., $CP[j]$. The chosen probability of u_j to receive EC is computed as follows.

$$CP[j] = \frac{RP[i,j]}{\sum_{k=1}^{n} RP[i,k]} \tag{6}$$

3 The System Analysis of SocialWiki

To identify high quality contributors, SocialWiki allows users to provide the following three types of feedbacks.

- Indicating the intention of contribution ("Like", "Neutral", "Dislike"): This adjusts the trust values associated with the social path between two consecutive EC holders, which is used in (3). It is also used as feedback to previous collaborations and further an indicator for future collaborations, as computed in (4).
- Rating previous contributors: As the revision history for an article is available to all users, users may be able to tell whether they like or dislike to collaborate with other users from the content they contribute. Such ratings allow users to specify their preference for potential collaborators.
- Indicating if an article is a spam page: This is a punishment to an article. If a user marks an article as spam, he/she will never receive its EC again.

Supporting Diversity It is possible that two communities holding opposite opinions on the same issue provide poor feedbacks to each other, i.e., the EC is less likely to be transferred from one community to another. The probabilistic EC circutaltion given by (6) makes it possible for the other community to revise the article, although with a small probability. Once the EC is assigned to a user within the other community, it will have a large probability to stay within that community for a while. As a result, opinions from both sides can be reflected in the article.

Preventing Vandalisms Traditional wiki systems need huge human effort to fight vandalism. SocialWiki limits editing privileges with EC. With the probabilistic circulation model, the probability for vandalists to receive EC can be rapidly reduced if other users express discontent with their behavior. Therefore, vandalism can be reduced in SocialWiki without requiring a lot of attention from wiki administrators.

Since each EC is routed through a social path, when it is circulated to a vandalist who is connected to a reliable user, the EC might circulate within an unreliable user group if the vandalist cuts off his/her connection with all reliable users right away. However, under the assumption that we have many more reliable users than vandalists in the system, there still exists some probability that the EC will be circulated to reliable users. Once reliable users get the EC, the whole vandalism group will be identified and their reputation will be punished.

Preventing Spams Spam is usually defined as unsolicited advertising for self-promotion or promotion of a business or organization. There are two types of spams in SocialWiki:

- External link spamming that provides nothing more than a link to the spammer's commercial web site.
- Advertisement articles that sell stuff for a business, product or service, or are individual self-promotion.

The first type of spams commonly exists in traditional wiki systems. In SocialWiki, the probabilistic circulation model restricts it in the same way as treating

vandalism. However, the probabilistic circulation model may amplify the destruction of the second type of spams.

To prevent/reduce the second type of spams, SocialWiki employs a reputation system to identify both spam users and spam articles. Given a topic (synset) j, the reputation for user u_i is computed as follows.

$$\text{Repu}[i,j] = 1 - \frac{|F_{spam}(i,j)|}{|F(i,j)|} \tag{7}$$

where $|F_{spam}(i,j)|$ denotes the number of spam ratings for all articles created by u_i in topic j. $|F(i,j)|$ denotes the number of feedbacks for articles created by u_i in topic j. A small Repu$[i,j]$ means that u_i is considered to be a spammer in topic j by a majority of users. SocialWiki will stop circulating the ECs for articles created by u_i on the topic j and send these articles to administrators to review. Meanwhile, u_i will not be able to create similar articles within a certain period of time t_j.

To compromise this reputation system, a spammer u_i could launch a Sybil attack by creating lots of accounts and providing positive feedbacks to u_i. Such an attack, however, does not work well on SocialWiki as social context is used to compute the trust between users. A Sybil attack only gets u_i high trust within his/her own accounts and does not boost trust along a social path.

For an article a_k, its reputation is the ratio of spam ratings (denoted by $|G_{\text{spam}}(i)|$) among all ratings it receives (denoted by $|G(i)|$), i.e.,

$$\text{Repu}[k,j] = 1 - \frac{|G_{spam}(i)|}{|G(i)|} \tag{8}$$

Once an article a_k's reputation is below a certain threshold, it is marked as spam and the system hides a_k from the readers.

4 MinB: A SocialWiki Prototype

4.1 Generalization

We divide SocialWiki into two components, one to construct social context and circulate ECs, the other to store all articles and manage feedbacks.

We implement the first component as a Facebook application. With Facebook API, SocialWiki can use Facebook as the OSN layer to collect basic user information, such as profiles and friend lists. A social graph is built with the friendship information extracted from Facebook.

To improve user experiences, the first component is provided as a game named **"Message in a Bottle" (MinB)**. Each EC is embodied as a "floating bottle" in the "ocean". Every user has a private beach for the system to deliver bottles. When a bottle arrives at u_i's beach, u_i is able to edit the wiki article bound to this bottle.

The second component is implemented with MediaWiki [2], an open source wiki package written in PHP. We modified MediaWiki to enable access control and user feedback. MediaWiki has an access control table for user groups and their privileges on each article. Restricting an article's editing privilege to some users can be implemented by adding these users to its editing group.

To connect these two components, each bottle in MinB contains a link to an article in our wiki system with credentials to authorize the user to edit it. After submitting his/her changes to our MediaWiki, the user tosses the bottle back into the "ocean" and the system will deliver it to another user. Fig. 4 shows how these two components work with each other.

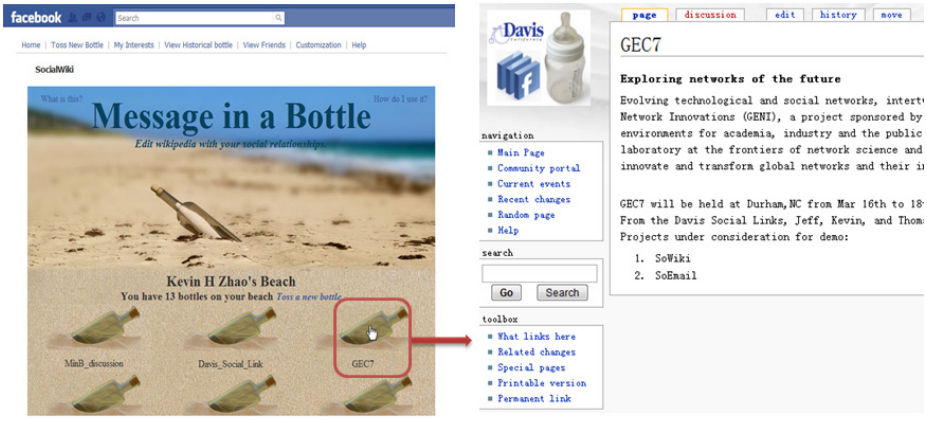

Fig. 4. User Interface

4.2 Workflow

Creating an Article To create a wiki article, a user u_i first creates a bottle (EC) in the MinB application, by setting some article parameters, including subject, keywords (synsets), expiration date, and maximum holding time. Expiration date defines a time limit after which nobody can edit this article. It is an option for special collaborations, such as paper reviews. Maximum holding time prevents a user from holding a bottle forever, therefore other users get the chance to review/revise the article.

After initializing the bottle, MinB creates a relevant article with access control in our MediaWiki and adds u_i to the article's editing group. Then, MinB provides u_i with the article's link encrypted by u_i's login information so that u_i can access and edit the article through the hyperlink inside the bottle. Fig. 5 shows the process of creating a bottle and initializing its configuration.

[2] `http://www.mediawiki.org/wiki/MediaWiki`

Fig. 5. Creating a Bottle

After u_i tosses the bottle into the "ocean," MinB sends the bottle to the "beach" of another user u_j (EC circulation) and replaces u_i with u_j in the article's editing group.

Providing User Feedback Once a bottle (EC) arrives at user u_j's beach, u_j may follow the link inside the bottle and edit the corresponding wiki article. u_j can also provide feedbacks to previous revisions, which updates the trust and EC circulation as we have discussed in Section 3. Providing feedback to historical revisions may directly influence the trust relationship. Feedbacks are anonymous to other users thus true opinions can be reflected. Since u_j's feedback may have influence on the intermediate users between u_j and other contributers, SocialWiki enables u_j to view their social paths before make a punishment decision. Fig. 6 shows the user feedback interface. In this example, if Kevin does not like Felix's revision, but he does not want to reduce his trust with Prantik, he may choose not to submit a negative feedback.

Initializing User Context When a Facebook user u_i joins the MinB application, two steps are performed to initialize the social context for u_i. The first step is to build social paths for u_i, i.e., import his/her friend list from Facebook and then update the social graph MinB has. The second step is to initialize u_i's interests. u_i needs to provide a set of keywords to represent his/her interests. Then the system groups them according to synsets and updates V and U. Fig. 7 shows the keyword management page in MinB.

4.3 Current Progress

MinB was released in early March 2010. The prototype has user interest, trust management and EC circulation components implemented. A MediaWiki site

Fig. 6. User Feedback Interface

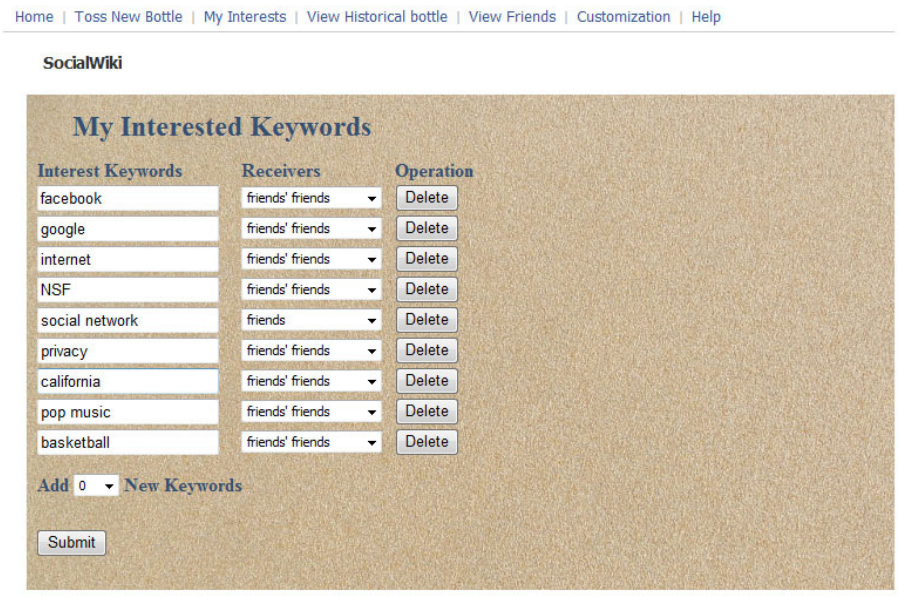

Fig. 7. Keywords Management Interface

with access control and user feedback has also been developed. Currently, interest description is based on keywords and we are planning to switch to synsets. Meanwhile, the feedback for previous contributors are not considered in EC circulation yet. Although we still have some components to improve, there are already 40 early users joining MinB and more than 80 wiki articles have been created. As this project is still in its infancy stage, we expect to report an evaluation after collecting more user data and feedbacks.

5 Related Work

Many efforts have been made to integrate user interests and trust into social networks, especially in recommender systems.

One of the most commonly used algorithms to estimate user interest context is the k-nearest neighborhood approach. By calculating the Pearson correlation [13] between a user u_i and all other users in the system, the top k nearest ones are selected as the set of similar users of u_i. Such algorithms are known as collaborative filtering (CF) [13].

However, the generic collaborative filtering method alone exhibits poor scalability to large number of users and items [12]. A pre-filtering or scalable neighborhood formation (such as a subgraph or community) is preferred to assist CF in real world systems. Sinha and Swearingen [14] found that people prefer receiving recommendations from people they know and trust. Recently, approaches incorporating trust models into online recommender systems have been launched [5, 6, 8]. Olsson [10] proposed an architecture combining trust, collaborative filtering and content-based filtering. Trust has become a supplementary or even a replacement of existing filtering mechanisms.

A trust-based approach has also been investigated in wiki systems. Adler et al. [1] proposed a content-driven reputation system for Wikipedia authors. In their system, authors gain reputation when their edits are preserved by subsequent authors, and lose reputation when their edits are reverted quickly. Thus, author reputation is computed based on content evolution only and user-to-user comments or ratings are not used.

SuggestBot developed by Dan [4] performs intelligent task routing (matching people with tasks) in Wikipedia by using broadly applicable strategies including text analysis, collaborative filtering, and hyperlink.

The difference between SocialWiki and previous work lies in an enhanced trust model considering strong social context.

- Trust propagates along social paths, which ensures online collaboration with a large number of reliable contributors.
- The trust in SocialWiki is associated with topics and provides flexibilities to specific collaborations.

The name "SocialWiki" was used before in [9] and by Socialwiki.org [3], both of which are quite different from our work. [9] targets collaborative workflow

[3] `http://socialwiki.org/`

design and activity management. It presents a workflow system that is based on wiki and changes the wiki context from public to organizational. Socialwiki.org provides a collaborative and open platform with MediaWiki for social media discussions. Both of them employ the traditional wiki system as a platform for their applications, rather than remodeling the wiki system.

6 Conclusions

This paper presents a collaborative editing system based on social interest and trust. Social context, such as user interest and trust, is used to select high quality and trustworthy contributors. We discuss how to construct user interest and trust with the information provided by online social networks. We also describe methods to prevent spams and vandalisms.

A prototype of SocialWiki, MinB, has just been released on Facebook. Lots of improvement is needed to make it more user friendly, efficient and scalable. Currently we are working in several directions. Getting more users to test our system and give us feedback is certainly important. At the same time, we plan to use simulations to expose the problems and limitations of our current system, for example, how fast the system detects and prevents spam under various attacks and how the weight factors in (6) can be tuned accordingly. Meanwhile, we are considering to evaluate how soon valuable editors will get the chance to edit an article. We plan to allow users to request an EC based on their reputation, historical contribution, and social context. We also consider to bring in more valuable editors from other online social networks such as Linkedin.

Acknowledgement

The authors would like to thank Thomas Tran for his valuable contribution and feedback during system development. This work was supported by the National Science Foundation Future Internet Design program under Grant No. 0832202, MURI under Army Research Office and Network Science CTA under Army Research Laboratory.

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