

---

# Finding Your Way with CampusWiki: A Location-Aware Wiki

**Richard P. Schuler**

Information Systems  
New Jersey Institute of  
Technology  
University Heights  
New Jersey 07102 USA  
rps22@njit.edu

**Nathaniel Laws**

Information Systems  
New Jersey Institute of  
Technology  
University Heights  
New Jersey 07102 USA  
ndl4@njit.edu

**Sameer Bajaj**

Information Systems  
New Jersey Institute of  
Technology  
University Heights  
New Jersey 07102 USA  
sameer.bajaj@njit.edu

**Sukeshini A. Grandhi**

Information Systems  
New Jersey Institute of  
Technology  
University Heights  
New Jersey 07102 USA  
sg49@njit.edu

**Quentin Jones**

Information Systems  
New Jersey Institute of  
Technology  
University Heights  
New Jersey 07102 USA  
qjones@njit.edu

**Abstract**

Wikis provide a simple and unique approach to collaborative authoring, allowing any member of the community to contribute new, or change existing information. However, Wikis are typically disconnected from the physical context of users who are utilizing or creating content, resulting in suboptimal support for geographic communities. In addition, geographic communities might find the highly skewed generation of content by a few individuals problematic. Here we present research into addressing these challenges through location-awareness and lightweight user content rating mechanisms. We describe one such location-aware Wiki, CampusWiki and initial results from a field study demonstrating the value of location-linked content and the rating approach. We conclude with a discussion of design implications.

**Keywords**

Wiki, collaborative authoring, location-awareness.

**ACM Classification Keywords**

H.5.3. Group and Organization Interfaces: Collaborative Computing.

---

Copyright is held by the author/owner(s).

CHI 2007, April 28–May 3, 2007, San Jose, California, USA

ACM 978-1-59593-642-4/07/0004.

## **Introduction**

There are several existing location-based context-aware systems that utilize user location to enhance user experience [7]. Some have been created to help people navigate geographic places [1, 4] while others have been created to facilitate social development [6]. Most such systems require proprietary software to be installed on specific wireless devices.

The Wiki format [11] is a flexible, web-based tool in which users contribute knowledge that can be used by the whole community. It has been used for many different purposes such as software development [9], teaching [3], and profit [8], demonstrating its versatility for use in different contexts. It is a simple and lightweight method for communities to exchange information and develop their own knowledgebase.

In this paper we present CampusWiki, a location-aware Wiki that combines traditional Wiki characteristics with location-based context-awareness. Our objective is to investigate the utility of such a system as a community-building and orientation tool for a geographically collocated community.

Content generation in a Wiki typically follows Zipf's law [2, 12], i.e., a very small percentage of users contribute a very large percentage of the content. For CampusWiki to be as successful as a collocation community-building tool, we need to elicit contributions from a larger proportion of users. Therefore, to complement traditional Wiki contributions (page creation and edits) we have added a lightweight method of contributing to CampusWiki, i.e., user-specified ratings.

In this paper, we first present our initial Wiki design and implementation. We then describe our field study. Finally, we conclude with a discussion of how our findings show that location-awareness is useful for our target community and that the rating tool is a useful alternative way to contribute to Wiki content.

## **CampusWiki: Design and implementation**

Like all Wikis, CampusWiki contains all content on a specific topic in a single page. There are six categories of content: people, places, organizations, events, courses, and other. The first four categories were chosen as we believed them to be of most interest to our student community, while the latter two were suggested by student feedback. These categories allow information to be grouped and more easily accessed.

### *Location-awareness*

Our goal was to enable every student to be able to take advantage of the location-awareness, while maintaining the simplicity of the Wiki model and keeping all functionality within the web browser. We also wanted to ensure that our students did not have to install or run any additional software. We developed a two-step method to achieve these goals: first, determining a student's location when accessing the Wiki, and second, tying each content page to a specific location.

Our method for determining a user's location is as follows. All wireless access points are associated with a physical location (a building and floor). Once each access point is associated with a location it is then possible to estimate the location of any computer using the wireless network. Each computer has a unique identifier, a Media Access Control (MAC) address, which is associated with its wireless network card. We log all

instances of these MAC addresses as they connect to and disconnect from access points. When a student accesses CampusWiki we capture their IP address, and then, utilizing a server that is located on the wireless network, initiate a reverse address resolution protocol (RARP) lookup to determine the MAC address that is associated with it. A lookup is then performed to determine which access point the current MAC address is connected to. Using this information we can then estimate the student's location. We would like to point out that although the MAC address is a unique identifier for a specific computer, privacy is maintained because it does not have any user-associated information. And although it is possible to capture and log such information and attempt to associate individual users to a MAC address, our system is designed not to do this. So, we maintain the privacy and anonymity of our students.

Determining a user's location is only part of the solution. The next step is providing content that is location-aware, but fits into the Wiki model. This is achieved by adding some semantics [10] or meta-data to each page. Each content page in CampusWiki is associated with a building, floor, and room number. This provides the location information necessary to support our location-awareness features. Additionally, each page has an associated category and meta-data unique to that category. As in traditional Wiki content, this category information must be provided by the user creating the content page and is not automatically generated. However, once created, it allows for a few unique features not seen in previous Wiki implementations.

When a locatable user (a wireless user) connects to CampusWiki, he/she is shown the location page associated with his/her determined location. For example, if a wireless user connects from the cafeteria, he/she will receive the location page for the cafeteria. This page has all the information that the community has provided about that location, in addition it also displays four sets of links (link set) from each content category these sets are as follows: nearby (pages that are associated with a building and floor close to the current user), popular (pages that are currently generating the most page views), recent (pages that have been newly created or edited), random (pages that have been randomly selected).

Nearby links are provided so that along with the information contained in the content page, the student can also quickly know what else is in close proximity. This allows students unfamiliar with the campus to learn about their surroundings. In addition to the location page having nearby links in proximity to the determined location, all other content pages in the Wiki also display nearby links in proximity to the associated location for that page. This allows a user to navigate content geographically as well as topically. In this way location-awareness might also addresses some of the navigational problems confronting users of more traditional Wikis [5].

#### *Ratings*

We have devised a novel way for the community to contribute content, mitigating the typical problem of few individuals providing most of the content: allowing students to create their own unique rating labels on content pages. For example, a content page about a person may have a rating label called "crazy" allowing

any student to rate how “crazy” they think that person is. If a student feels that a page does not have a rating label of their choice, they can create one themselves. This allows for two lightweight methods of contribution, the creation of rating labels, and the rating itself on scale of one-five stars.

The practical utility of the rating system to the school is also clear. For example, if many students rate the cafeteria as dirty and having poor service then that can be brought to the attention of the administration. But, in order for the rating system to be useful, each student should be allowed to rate each rating label only once. This is achieved by requiring students to authenticate before rating. There is a record of the rating label each student rates but not the rating they give. This allows a one-person one-vote rating system to exist and limits the potential for ballot stuffing, while keeping the ratings anonymous and protecting students’ privacy.

### **Research questions and hypothesis**

Initial finding regarding two of the research questions we are exploring with CampusWiki are presented here. First, we wanted to examine if adding location awareness to a Wiki provides value for co-located communities. Second, would lightweight rating mechanisms encourage broader participation by the user community in content creation? To address these questions we hypothesized the following usage patterns in CampusWiki.

Hypothesis1: When locatable users are provided with the link set on the location page, nearby links will be clicked as much as or more than other sets of links.

Hypothesis 2: Ratings as a method of content provision will be used as much as or more than traditional methods such as creating and editing pages.

### **Method**

In order to facilitate the testing of hypothesis 1, we required a method to determine if location-aware (nearby) links were in fact useful to our students. Each location page presents the students with four sets of links (nearby, popular, recent, and random), each subdivided into four categories (people, places, organizations, events). These four sets of links will help us compare the relative utility of location-aware (nearby) links.

While our data contains 207 pages associated with a floor/building, for the purpose of our analysis we picked the two buildings that recorded the largest number of associated pages - 1) the Campus Center that recorded 65 associated pages and 2) the ITC building that recorded 33 associated pages. These two buildings provide wireless access and also typify the common social and school related student activities on campus. The Campus Center is the largest social gathering place on campus and houses the cafeteria, student club rooms, game rooms, computer labs and other public places. The ITC building is an office building that houses many department offices, labs, and classrooms.

To obtain meaningful usage statistics we recorded most actions that were conducted while using CampusWiki, including new page creation, page edits, page ratings (distinct from a page edit), page views, searches, and links clicked. In order to maintain privacy and anonymity there was no user information collected. All statistics and use data are from logs gathered during

the time span of September 17<sup>th</sup> 2006 through December 31<sup>st</sup> 2006. Over a period of 106 days we had over 18,500 page views, 177 new pages created, 584 page edits, and 549 ratings. We recorded a total of 34365 actions, with 6191 (18%) associated with locatable users.

## Results

The total number of clicks in the link set, at each location is shown in Table 1. Chi-square tests were performed on the number of links clicked in each subset, for each building. For the Campus Center,  $\chi^2$  (3, n=61) =19.45,  $p < 0.005$ , for ITC,  $\chi^2$  (3, n=43) =10.30,  $p < 0.025$ . All results were significant, showing that in both locations (CampusCenter and ITC building) where nearby links were available, they were clicked as many or greater number of times. These results support hypothesis 1.

Table 1: Number of clicks by location & sets of suggested links

Building	Nearby	Popular	Recent	Random
Campus Center	24	17	19	1
ITC	16	5	16	6

To test hypothesis 2, we compared the number of ratings to the number of new pages created and the number of edits made (the two traditional ways of contributing to a Wiki). We found that students contributed almost five times as many ratings (n=549) as new pages created (n=177), and contributed as many ratings as page edits (n=584), supporting hypothesis 2. A Chi-square test showed significant differences in the number of contributions made by ratings and by page creation/edits,  $\chi^2$  (2, n=1310) = 233.03,  $p < 0.005$  ( $\Phi = 0.42$ ). This shows that students

use ratings as a means of contributions much more than traditional means of page creations, and as much as traditional page edits. It reinforces our assertion, and our goal, that lightweight alternatives to traditional content creation methods, like rating mechanisms, will encourage participation.

## Discussion

Our results show that the addition of location-awareness to a Wiki adds value for a co-located community. These initial findings are a good indication that adding location-awareness to other similar web based systems, such as forums, would be of value to co-located communities. This also illustrates that systems that wish to take advantage of location-awareness need not be large and complex; instead they may be created as lightweight web-based applications. It is also important to note that the nature of Wiki (community members creating and editing content) removes the burden of providing content from administrators. It does however create the issue of content management and monitoring, and needs more investigation. The ratings feature was added as a quick alternative to traditional Wiki contribution and was designed to increase participation and student involvement, and not just to create a corpus of knowledge. Its usage demonstrates that students recognized its value as a lightweight contribution mechanism. Future Wikis need not be dependant on the traditional Wiki content creation methods and should investigate alternatives that are unique to their target audience

## Conclusions and future work

CampusWiki is an innovative extension of the Wiki model. Our data shows that it supports the

geographically connected community of urban university students with the addition of location-awareness. Also, the addition of ratings provided another method of content creation, allowing for more active participation from the community. These results show that Wikis with additional features that support their target communities can extend the Wiki model into new domains.

### Acknowledgements

This research is partially supported by the National Science Foundation (NSF CISE 0454081 and 0534520). The opinions expressed are those of the authors and may not reflect those of the NSF.

### References

- [1] Abowd, G. D., Atkeson, C. G., Hong, J., Long, S., Kooper, R., and Pinkerton, M., Cyberguide: A mobile context-aware tour guide, *ACM Wireless Networks*, vol. 3, pp. 421-433, 1997.
- [2] Benkler, Y., *The Wealth of Networks: How Social Production Transforms Markets and Freedom*: Yale University Press, 2006, p. 72.
- [3] Chien-min, W. and Turner, D., Extending the wiki paradigm for use in the classroom, in *International Conference on Information Technology: Coding and Computing*, 2004, pp. 255-259.
- [4] Davies, N., Cheverst, K., Mitchell, K., and Efrat, A., Using and determining location in a context-sensitive tour guide, *Computer*, vol. 34, pp. 35-41, 2001.
- [5] Désilets, A., Paquet, S., and Vinson, N. G., Are wikis usable?, in *Proceedings of the 2005 International Symposium on Wikis* San Diego, California: ACM Press, 2005.
- [6] Espinoza, F., Persson, P., Sandin, A., Nyström, H., Cacciatore, E., and Bylund, M., GeoNotes: Social and navigational aspects of location-based information systems, in *UbiComp 2001: Ubiquitous Computing: Third International Conference* Atlanta, Georgia: Springer Berlin, 2001, pp. 2-17.
- [7] Jones, Q., Grandhi, S. A., Terveen, L., and Whittaker, S., People-to-People-to-Geographical-Places: The P3 framework for location-based community systems, *Computer Supported Cooperative Work: CSCW: An International Journal*, vol. 13, pp. 249-282, 2004.
- [8] Levine, R., New Web Sites Seeking Profit in Wiki Model, in *The New York Times* New York, 2006.
- [9] Louridas, P., Using wikis in software development, *IEEE Software*, vol. 23, pp. 88-91, 2006.
- [10] Völkel, M., Krötzsch, M., Vrandečić, D., Haller, H., and Studer, R., Semantic Wikipedia, in *Proceedings of the 15th international conference on World Wide Web* Edinburgh, Scotland: ACM Press, 2006.
- [11] Wiki <http://en.wikipedia.org/wiki/Wiki>
- [12] Zipf, G. K., *The Psychology of Language*. New York: Houghton-Mifflin, 1935.