Search Query Share for Enhancing Communication in a Small Community

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***Abstract*—Queries entered into search engines, such as Google, are used for a variety of purposes, such as satisfying user interests and finding some solutions. Some researchers focus on the search queries in order to extend the user interaction and information support. This is because the search queries include user intentions and circumstances. We assume that sharing the search queries can be applied not only to the online virtual world, but also to the real world; in particular, we focus on applying these in a small community. The opportunity of conversation is increased by sharing search queries, which show the user's interests and intentions in a closed community.**

Keywords-search query; communication; small community; search query share.

I. INTRODUCTION

Queries entered into search engines, like Google, are used for a variety of purposes, such as satisfying user interests and finding some solutions. Some researchers focus on the search queries in order to extend the user interaction and information support. This is because the search queries include user intentions and circumstances. Matsui et al. [1] support information exchange among people who have the same interests. It provides online chat conversation to the people who use the same query at the same time on the Internet. Previous studies [2][3][4][5] show that the efficiency of web search activity is improved when referring to the browsed history of other people who used the same search queries. These existing researches support online communication, collaboration retrieval, and other online collaboration. In this research, we assume that sharing the search queries can be applied not only to the online virtual world, but also to the real world; in particular, we focus on applying these in a small community.

Shared spaces, such as lounges, corridors or kitchens, are important areas for informal communication and sharing information. Some researches provide opportunities for communication in order to utilize specific informal communication [6][7]. Although those researches support incidental encounters and provide opportunities for a starting point of a conversation, they do not provide the conversation topic. HuNeAS and Cyber-IRORI intend to provide the conversation topics [8][9]. However, these studies focus their attention on the method of how to express information among community participants. Also, there is no mention on how to start a conversation topic.

We assume that starting a conversation from incidental encountering happens quite often in small communities, such as a university laboratory or a small office. Also, we assume that events in daily lives, interests and thinking among participants of small communities tend to be shared as conversation topic. Therefore, the opportunity of conversation is increased by sharing search queries which show user's interests and intentions in a closed community.

The remainder of this paper is structured as follows. Section II describes related researches. Section III describes search queries and conversation topic. Section IV shows an architectural overview of our system and the user study conducted by our system. In Section V, we discuss our findings. Finally, Section VI concludes this paper.

II. RELATED WORK

In this section, we describe related researches of enhancing communication among the community.

A. Provide an Opportunity for Conversation

Meeting Pot matches the timing of people to meet each other [6]. This system detects the presence of people in a break room by monitoring the state of a coffee maker. When it detects people gathering, the system informs the colleagues in personal offices by using a coffee aroma generator as implicitly communication.

Also, communications tend to be neglected in office work spaces by partition panels that make up a personal cubic space. A psychological barrier not to visit other personal space tends to be caused by the physical partition panels without any special reason. TravelingCafe compensates the psychological barrier in such an office [7]. This system monitors the remaining amount of coffee in their cup with pressure sensors. By displaying the remaining amount of all member’s coffee cups beside the coffee maker, this system give a reason to visit some colleagues to "come to pour some coffee", and that might start a conversation. The psychological barrier of hesitating to visit other personal space is reduced by that system. Furthermore, they supposed that the subjects became tolerant to "visit" and "being visited." Also, they reported that the system can create new communication because the communication between two persons is extended to communication among multiple people at the same rate as the one used in a break space.

This research shows that synchronizing break time among people can cause a chance of occurring

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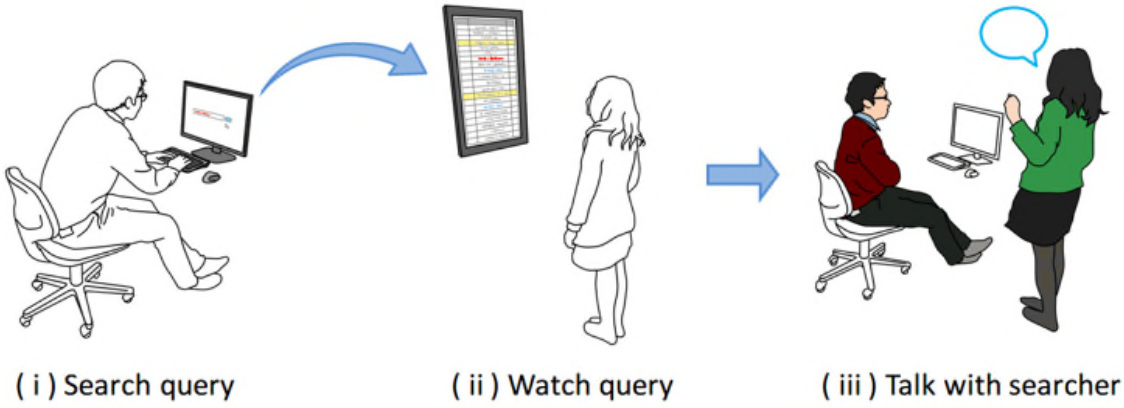

Figure 1. Concept of proposed system

communication. However, a common topic of conversation is not provided in the system. We assume that providing a common topic among colleagues is important as well as the synchronization of break time.

B. *Conversation Support in a Shared Space*

HuNeAS studied encounters of people in a shared space [8]. HuNeAS promotes information sharing by indicating the required information on a large display placed in a common space such as a corridor or a lounge. At the same time, to enhance the information sharing in that community, HuNeAS gathers information from all users and places it on the large display.

Cyber-IRORI showed that coziness is important for supporting informal communication [9]. It provides a reason and the justification to visit/stay at the shared space. Cyber-IRORI consists of a touchable table-top display, a vertical display, and imitated hearth. This system displays news and web pages read by the community members on the touchable table-top display as articles. Also, when a member choses a certain article, the article is displayed on another larger display which can be seen from anywhere in the community room. They described that Cyber-IRORI encouraged the users to stay/visit the shared informal space and was able to enhance conversations.

III. SUPPORT CONVERSATION WITH SEARCH QUERY

As mentioned before, queries input to search engines like Google are used for a variety of purposes, such as satisfying user interests and finding some solutions. Some researchers focus on the search queries in order to extend the user interaction and information support. This is because the search queries include user intentions and circumstances. Matsui supports communication among people who search the same query [1]. Yamaguchi, Tan, Tanaka, and Takeda made online-searching more efficient by using searched queries used before as reference [2][3][4][5]. According to existing studies, we assume that the advantage of sharing query for people in a small community is increases the opportunities of conversation.

A. *Search Query and Conversation Topic*

Our research focuses on a certain community where people are acquaintances and talk to each other quite often, such as a university laboratory and a small office. We assume that conversation topics tend to be about events in daily lives, interests and thinking among participants of a small community. When the conversational partner has no interest in a topic, the communication tends to become a one-sided conversation or the conversation is over in a minute. As we know, it is very important how much the partners of a conversation are interested in the topic in terms of having comfortable conversations. As we have described previously, search queries reveal user interests. There is a possibility that the search query is able to be the topic. Therefore, it is expected that opportunities of conversation are increased by sharing search queries as conversation topics.

In this research, to enhance communication among members of a small community, we propose a new query sharing system which indicates that queries searched by community members are available on large display in a shared space. Hence, we designed a system to increase the amount of conversation by sharing queries which someone are interest in when they visit a shared space. Fig. 1 shows the basic concept of the system. Fig. 2 shows the actual display placed in shared space in this experiment. Note that, at this time, we place the display in a shared space because we suppose to observe face to face communication in real space, and it is easy to sample data of people behavior in a shared space. Also, we did not want to interfere with someone's work by sharing queries in personal space. Basically, we can realize the query sharing system on each PC in a personal space, such as an office cubicle space. We believe that our proposed system can be applied to full online style and can produce same or more effect when queries that are shared only on one display.

IV. USER EXPERTIMENT

In this paper, we defined "search query shared among small community" as "closed query". We want to measure the effect of a closed query. This section describes the details

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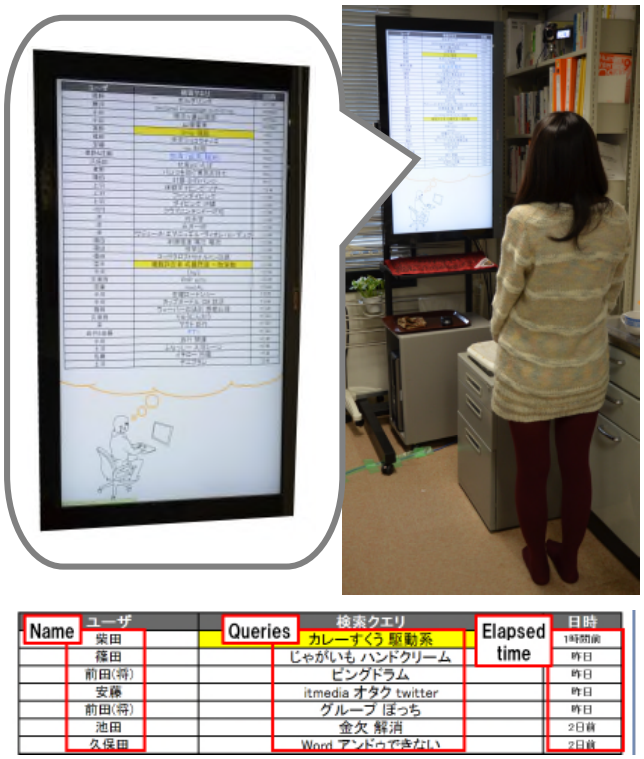

Figure 2. Large display placed in shared space and displayed closed query and part of list of queries.

of the experiment and evaluation gathered from a questionnaire.

A. *"Global" and "Local" Query*

We conducted a user study to compare a closed query with a "hot word", which is a word used in lot of people searches. We thought that a hot word cloud be regarded as a global query which is symmetrical about closed query. This way, we investigated whether a closed query is more effective to increase opportunities of conversation than any queries. This section describes the design and the result of the comparative experiments.

The system indicates list of "closed query" on a large LCD (SONY KDL-40EX500:40-inch LCD TV) in 7 days, as shown in Fig. 2. The list is composed of 35 “closed query”s and the name of the person who searches “closed query”, as shown in bottom of Fig. 2. After that, the system indicates the list of "hot words” for 7 days as well. In this situation, we believe that the order effect was negligible. We conducted a questionnaire investigation after each period. In this experiment, hot words were displayed one week after the queries were closed. Closed queries were obtained from search form implemented Google Chrome extension (Fig. 3). Therefore, participants can adopt inputting the search query to the implemented form or usual form whether or not they want to share the query. Also, we deploy a video camera beside the display to observe whether subjects are interested in displayed queries when they visit the shared space. This experiment was conducted with 17 subjects (gender: 16 male and 1 female; age: 22 to 25). Also, trend words of Yahoo! Japan Search data are displayed as hot word [10]. The trend words are updated every hour and 3 words are added on that screen.

Figure 3. Search form implemented Google Chrome extension

TABLE I. QUESTIONNAIRE ABOUT SHARING CLOSED QUERY

P1	Did you check the search query frequently when you were in the shared space?
P2	Did you have interest in search queries?
P3	Did you incline to talk about the search query?
P4	Did you try to talk about query with the searcher?
P5	Did you talked about search query?
P6	Did you feel uncomfortable sharing own queries?
P7	Did you have interest in other's queries before experience?
P8	Did you have interest in other's queries after experience?
P9	Did you feel conversation was increased in small community?
P10	Did you feel conversation is efficient for small community?
P11	Do you want to use this system in future?

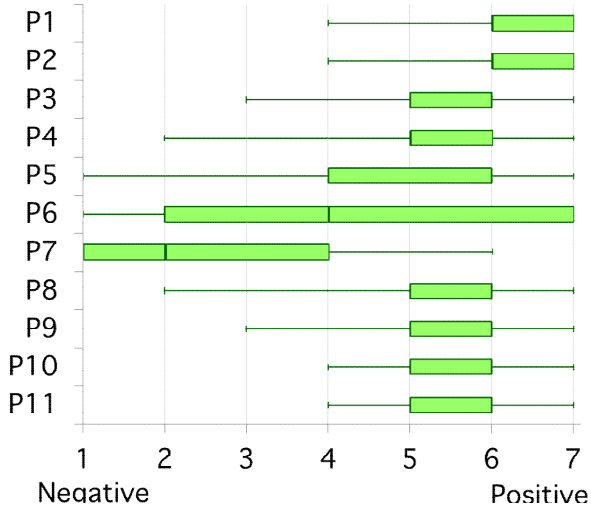

Figure 4. Evaluation of closed query

B. *Influence on Communication in Closed Query*

We carried out a questionnaire survey on an absolute scale from 1 to 7 (1: Negative 7: Positive) to 17 subjects after experiments. Table I shows the questionnaire items and Fig. 4 shows the results after the closed queries were shared.

Almost all subjects who visited the shared space checked the closed queries (P1), and they were interested in the closed queries (P2). They said that "It was interesting that I was able to see other's new side, such as interests, thinking, and progress of work." According to the user comments, almost all subjects had a good impression about the closed queries of others. Also, they shared their closed queries (P3, P4, P5). Even subjects who did not like to share their search query were interested in the closed queries and had conversations about the closed query. Also, there were variable comments about sharing closed queries. Some comments were on the negative side, such as "I didn't want to be known that I searched something very basic. I do not want others to think I am not very knowledgeable.", "Sharing my hobby makes me feel ashamed". In addition, as the opposite opinion, "I share the queries about my hobby mainly because I thought that it was boring even if a serious conversation with queries about research." All subjects tended to be aware that queries cloud be shared as topic. Subjects who were not interested in other's queries, became interested in closed queries. We suppose that their decision to share search queries increased because they could obtain a variety of information from closed queries.

Also, we observed that some people searched the same query at the same time. This means that they had deep interest and conversations with those close queries.

C. *Comparison between "Closed Query" and "Hot Word"*

We deployed a video camera beside the display to observe whether subjects are interested in the displayed search queries when they visit the shared space. Therefore, we counted the frequencies of visiting the shared space and checking queries at that time. Table II shows the number of times that subjects have visited by subjects shared space. Also, we have compared search queries during the most crowded four hours between 15:00 to 19:00 on each day of displaying closed query and hot word. In addition, the date of the observation was chosen when it seemed that enough time has passed since the start of the experiment. This was done in order to compensate for the initial curiosity of deploying the new system. However, this data seems to be just for reference because we analyze only one day.

When subjects visited the shared space, they checked the display at a frequency of 34.8% in case a closed query was displayed. They checked display at a frequency of 18.3% in case a hot word was displayed. Also, few subjects checked the hot word more than once a day. However, almost all subjects check the hot word just once a day. We can say that subject who is interested in the closed query does not have an interest in the hot word. Therefore, it was indicated that there is a difference in the frequency with which the search query was seen.

Next we describe comparison experiment of closed query and hot word. Fig. 5 shows questionnaire item and Fig. 6 shows results after the experiment.

Q1	Is your amount of checking closed query / hot word frequently?
Q2	Did you have interest in closed query / hot word?
Q3	Did you incline talking about closed query / hot word?
Q4	Did you talked about closed query / hot word?
Q5	Did you feel conversation was increased in small community?
Q6	Did you feel conversation is efficient for small community?
Q7	Do you want to use closed query / hot word sharing system in future?

Figure 5. Questionnaire for sharing closed queries

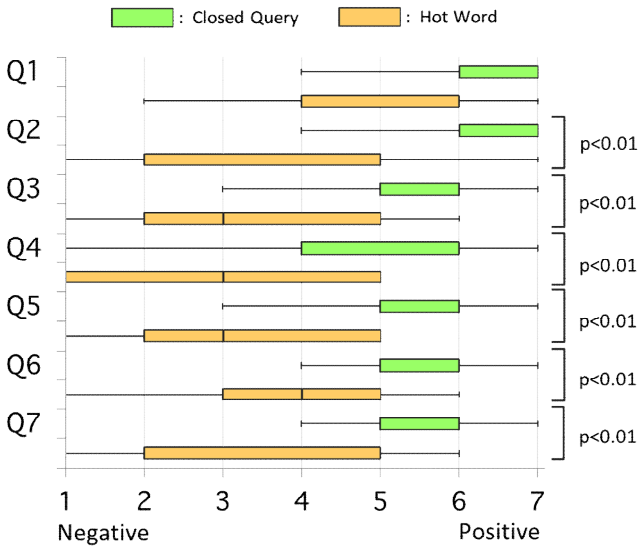

Figure 6. Result of comparing closed query and hot word .

TABLE II. FREQUENCY OF WATCHING CLOSED QUERY AND HOT WORD

	Number of times	
	Visit shared space	***Check display***
Closed query	69	24
Hot word	71	13

Using Wilcoxon matched-pairs signed-rank test, a significant difference was found in all items except for Q1 ($p=0.08$). It means that most subjects had often seen both the closed queries and the hot word (Q1). However, conversations caused by the hot word did not occur so much, and it was less than in case of sharing closed query (Q2, Q3, Q4). Closed queries made the subjects determine who was interested in what topic easily. On the other hand, sharing the

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hot word cannot initiate conversation as well as the closed query. Therefore, conversations caused by the hot word as topic occurred almost always when some subjects were "in a shared space" and "at the same time". Also, there were many comments such as "I was good to know the interest of the other party before a conversation."

D. Difference of Queries by Different Communities

Closed queries are classified into two types, such as "amusing and attractive word" and "word concerning work". In the previous experiment, a certain group tends to share "amusing and attractive word". On the other hand, other groups tend to share "word concerning work". Also, those two groups are researching difference topics and obeying a different group leader. Therefore, we divided the subjects into two groups and conducted the experiment in which closed queries were shared in each group independently. We observed the effect of the classification of these groups on the communication.

As a result, there were some positive comments, such as “It was easier to share a search query than in the previous experiment.” On the other hand, many subjects, especially within the group that tends to share queries of type "word concerning work", had a bad impression compared to the case when they shared a query with the entire laboratory. They said that “It was limited in what I said about the closed query.” and “It is difficult to talk about the query related study.” This reason is estimated that it is hard to talk about query because queries about "amusing and attractive" are decreased. This result might show that amusing and attractive words tend to be nice topics to start a conversation.

V. DISCUSSION

As a result of our system, conversation is promoted by sharing search queries in a small community. Indicating the closed queries and the user names who searched the closed query at the time, the closed query have become interesting topics for all conversation participants.

In this experiment, words relating to hobby were many in closed queries. It can be said that subjects who searched about hobby tended to use the proposed query sharing system. On the other hand, subjects who did not share the query much said "It was difficult to synchronize a timing to talk." or "I abstained from sharing queries about a hobby." These differences in type and amount of closed query were observed by groups. We consider that there is a difference of viewpoint in members of each group how to regard closed queries as. In future work, by conducting experiments in another community, there is a possibility that usage of the system and the type of closed query becomes different. We believe that we can obtain a significantly different result from this experiment when applied to a more intimate community such as friends, family members, and lovers. In addition, these experiments were conducted in collegial relationships. However, search queries were shared in reporting relationships like superiors, subordinates and supervisors, it is supposed that the proposed system become a useful tool in order to help with some projects.

Table III shows certain moments of closed queries in the experiments. We describe the searcher's conditions which can be estimated from those words. In this example, we classify those words by hand, not automatically. When the query is about a hobby, the news, or a topic word such as "*football match Serbia schedule*", "*Entrance examination disestablish*", or "*LEGAL HIGH* (TV drama in Japan)", it is supposed that subject is resting. Some subjects presumed to talk about fast-reading of English because they searched "*English fast-reading*" at the same time. When searching this type of words, the condition of the user can be categorized as "Resting". While in this condition, it is easy to start the conversation with the person who searches the same kind of words without feeling that you disturb them. Also, when the subjects search solutions, such as "*c++ log file input/output*", "*opencv plane detection*", especially when the subject searches the same or similar words repeatedly, such as "*php js function*", "*php function*", this may seem like a problem occured while working. These conditions are categorized 'In need'. Besides, in case queries are titles of paper and English words, the searcher is working. These searchers conditions are categorized 'Busy'. We assume that indicating closed query and user condition at the same time make starting communication more smoothly. For example, when someone is interested in closed query noticed with the 'Resting' condition, they might start communication without any hesitation. Also, by noticing 'in need' condition to people during a break, there is a possibility that a problem is resolved soon in case another person in the community knows the solution. We supposed that sharing search queries with searchers' conditions is efficient for enhancing opportunities of conversation start. Also, we suppose to consider and implement a classifier for deciding user’s condition.

TABLE III. CERTAIN MOMENT OF THE SEARCHER’S CONDITION ESTIMATED FROM THE SEARCH QUERY

Search Query	condition
football match Serbia schedule Entrance examination disestablish English fast-reading Grave of the Fireflies Kobe PE line leader LEGAL HIGH Osaka brass band regular concert	Resting
c++ log file input/output opencv plane detection php js function php function boost::serialization	In need
PocketTouch Skinput Large-scale learning of word ~	Busy

VI. CONCLUSION AND FUTURE WORK

In this paper, we proposed query sharing system to encourage conversations in a small community. Also, we studied whether there is a possibility that shared queries become trigger of conversation. By sharing closed queries and hot words in a small community, we observed that

members of small community are more interested in their closed query. Finally, we discuss and suggest that indicating a closed query and search condition at the same time make starting a communication smoother.

In future work, by conducting the experiment with another community, there is a possibility that usage of the system and type of closed query becomes different. We believe that we can obtain a significantly different result from this experiment when applied to a more intimate community such as friends, family members, and lovers. For example, search queries were shared in reporting relationships like superiors, subordinates and supervisors. Also, the authors believe that the proposed system becomes a useful tool in order to help with some projects.

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