Sharing of Baseball Event through Social Media

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ABSTRACT
As real-time broadcasting services are becoming more popular, many people are sharing live events with remote users. Despite the success of real-time broadcasting services, a number of restrictions still exist in such enriching the real-time events and indexing them in an automatic and implicit manner. In this paper, we present a social media platform to provide a novel environment for sharing real-time events. The social media platform employs emerging web environment, which is called "Tangible Web," to provide a new interface for watching real-time events and facilitate the production of socia1 media (e.g. instant chat, MMS, etc) with time and geographic tags. Produced social media enrich a corresponding real-time event and are utilized to index each session of real-time events. To evaluate our platform, a baseball cheering system was implemented and had taken closed beta tests for World Baseball Classic 2009 (WBC 2009) and 2009 championship series of the Korea Baseball Leagues.

Categories and Subject Descriptors
H.5.1 [**Information Interfaces and Presentation**]: Multimedia Information Systems–*Video*; H.5.3 [**Information Interfaces and Presentation**]: Group and Organization Interfaces – *Synchronous interaction; Collaborative computing*; H.3.1 [**Information Storage and Retrieval**]: Content Analysis and Indexing–*Indexing Methods*

General Terms
Design, Human Factors

Keywords
Social Media Platform, Video, Sharing, Indexing

1. INTRODUCTION
With the popularity of real-time events like sports and concerts, increasing number of people watch live video by accessing on-line streaming services. Recently, as watching real-time broadcasting on online became popular, new services such as real-time feed [12], scoring service [13], and mobile phone agent service [14] were launched to provide better experience. However, they are limited in annotating real-time events in a seamless way, and indexing of events is solely dependent to time-consuming but imprecise video feature-based indexing or later experts' descriptions. To give better support, it is necessary to provide a more promising framework for enriching real-time events and indexing them in a more automatic and implicit manner.

To solve above problems, we believe that social media can provide a practical basis. Social media are on-line tools that share contents, opinion, or perspective and support human need for social communication. For example, user-created contents from Facebook, Youtube, Twitter, and instant chats are popular examples. They provide cheap and accessible tools to anyone to publish information. They are known to be ambiguous, personalized, and often noisy, but a collection of them referring a same event can provide good sources for finding the most representative terms at the moment. Moreover, it can deliver instantaneous responses. The characteristics benefit us to have immediate but substantial understanding about a corresponding real-time event within a short time.

Examining social media to better organize and index was not a new idea. Shamma et al. [2] showed us a synchronized video watching system using messenger plug-in, and Collabora TV [3] provided environment to annotate videos using temporal comments and share them with others. They proposed social media sharing environment but focused on media sharing for non-real-time online video. However, our social media platform shows a practical approach suitable for real-time media, and we also propose a new social and tangible interface for enriching real-time events by encouraging people to produce more social media and utilizing to index real-time events.

Our social media platform's interface employs emerging web environment, which is called "Tangible Web [1]," to provide a new interface for watching real-time events and facilitate the production of social media. It builds virtual worlds which mirror the real world and pushes a new interface that seamlessly integrates between virtual world and real world. We implemented 2D/3D mirror world on where real time sports event are placed and utilize the Nintendo Wii remote controller to recognize the motion of users. As in [4][5], strengthen spatial representation by

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using a mirror world decreases perceived distances between users, and embodied interaction providing tangibility through motion recognition also plays a positive role of facilitating interaction among users. In our end-user interface, real-time video and social media from diverse devices were synchronously visualized in the mirror world, and a group of watching people shares them. We selected a baseball cheering system as an example domain for evaluating our social media platform, and have tested its feasibility for World Baseball Classic 2009 (WBC 2009) and 2009 championship series of the Korea Baseball Leagues. In these experiments, more than 300 people participated to test the usability of our system.

In this paper, Section 2 describes the proposed social media platform, then functional features of sports cheering system based on the social media platform will be shown in Section 3. Section 4 finally overviews algorithm for social media indexing and point-of-watching recommendation, and section 5 carries conclusion.

2. SOCIAL MEDIA PLATFORM

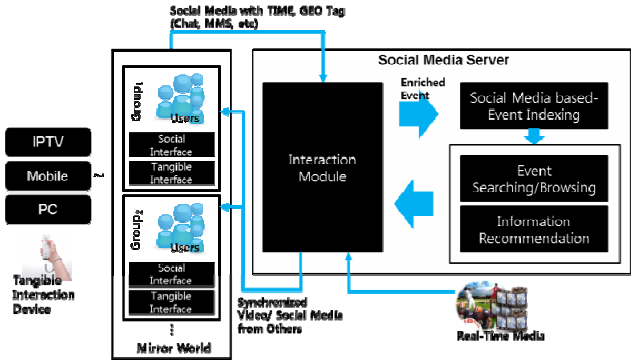

Figure 1. The overview of social media platform

Figure 1 shows the overview of social media platform. It assumes that a group of users are accessing the social media platform. The group means a community that shares same interest and interaction at the same time. It is a minimal unit of giving a synchronous feedback. In this system, there are multiple groups, and they receive a selected media stream & social media synchronously. While users are watching a real-world event in remote spaces or onsite of the real-world event, they participate to produce social media. The social media are accompanied by referencing time and geographical tags. For example, if users are watching a baseball game in the baseball stadium, they can take a picture or video using their mobile phones. They can directly send them to our social media server, Twitter, or Facebook with GPS and time tag[1]. Interaction module in social media server gathers and receives social media from user participation through diverse media devices like IPTV, mobile phone, or PC. Social media enriched with real-world events are published and utilized for later event searching/browsing. Based on the social media and the history of the event, additional information service similar to news recommendation can be provided.

In this paper, above social media platform was implemented for a real-time interactive baseball cheering system. In the baseball cheering system, it is important to provide interactive sharing environment with real-time media streaming. In an effort to provide better experience, we devised a new baseball watching and sharing interface. It will provide good environment to share social media and enrich a baseball event. Because a baseball game has a characteristic of having often break times (e.g. switching roles and changing a hitter), there exist enough time to interact each other and enrich the baseball event. Therefore, it is a good example domain to test the feasibility of our social media platform.

In this implementation, social media server subscribes a baseball event and gets real-time broadcasting of the baseball game. Users may produce social media contents watching a baseball game at home, and even people who are watching in a baseball stadium can participate in the social production of the baseball game event using mobile phones. Each session (e.g. the top half of 3rd) of real-time event is enriched by social media contents, that are utilized for indexing. Based on current context of baseball game, point-of-watching is automatically recommended by information recommendation module. It plays a role of a commentator who describes an event as it is happening.

3. BASEBALL CHEERING SYSTEM: FUNCTIONAL FEATURES

Baseball watching system which we implemented is an application built with a virtual mirror world. Users move around on the virtual stadium by browsing and experience social media with other users in a same community. Social media are visualized in corresponding spaces of their GPS tags in mirror world, and, in case of empty GPS tags, they are displayed in a layered-popup window. Our system provides four important functional features to facilitate social media contents that are explained in the following subsections: Mirror World Visualization, Social Interface, and Tangible Interface.

Figure 2. 2D/3D Mirror World

3.1 Mirror World Visualization

We implemented two versions of mirror world: 2D and 3D mirror worlds. They provide spatial meaning by enabling people to

[1] Time and geographical tags can be partially omitted, depending on the policy of clients.

interact with one another through a shared space [6]. As figure 2, a 3D mirror world visualizes users' interaction in the 3D virtual baseball stadium, and they can enjoy instant chatting and other social media from mobile phones or PCs. In case of a 2D version, we provide own seats for individuals, and visualize social media. In both mirror worlds, visual feedbacks are shared among users only within their community. Following user comments after closed-beta tests, people felt more co-presence when they cheered a game in the 3D virtual mirror world, on the other hand, in the 2D mirror world, they thought that it was easier to handle tremendous amounts of social media data.

3.2 Social Interface

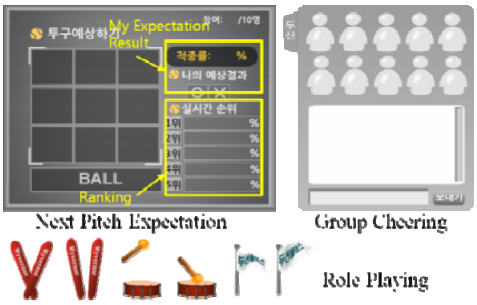

Figure 3. Social Interface: Next Pitch Expectation, Group Cheering, and Role Playing

For enriching real-time events and providing better experience, it is necessary to encourage social engagement and decrease social distance. In our implementation, a social interface was proposed to solve the problem. Through qualitative research including interviews and media analysis, we observed that two variables are important in baseball watching and figure 3 shows the UI elements of the two variables: group cheering and next pitch expectation. . First, group cheering makes people to cheer in a group enabling them to share and communicate their experience for experience sharing like instant chats [7]. In this group cheering, participants may have their own roles such as playing the drum and waving a flag; it has an effect of increasing co-presence. In addition to the basic group cheering property, the social interface supports collaborative cheering activities like a card section and tries to provide mutual dependency. Second, next pitch expectation system was implemented to increase synchronicity that encourage constant concentration to watching a baseball game. It contributes users to make more participation with competition among them. Using the system, users participate to predict a next pitch and get feedback about their scores and ranking after the next pitch.

3.3 Tangible Interface

Supporting only social interactions in real-world applications still have limitations of higher social engagement and satisfaction [8]. To overcome the problem, our baseball cheering system employs a tangible interface to reduce perceived distance between users. By providing physical manipulation functions using a tangible interface, it contributes to make their roles clear and to enhance their cheering interaction. For the tangible interface, we utilized the 3-axis motion sensor of a Nintendo Wii remote controller and implemented a classifier recognizing 4 types of gestures[2]. The recognized gestures were displayed by their own avatars in the mirror world.

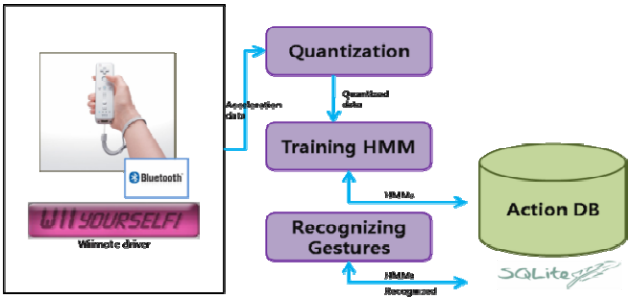

Figure 4. Structure of recognition gesture

Figure 4 shows an overall structure for gesture recognition. First, it allows users to define their own arbitrary gestures in the training process. Each acceleration data is quantized with their vector magnitude. The quantized data are utilized in HMM training with 4 states and circular topology, and then optimized by Baum-Welch algorithm [10]. After the training process, trained HMMs are stored on corresponding action DBs and recognize gestures under unknown acceleration data. In training and recognition processes, they used a leave-one-out method to filter sequences that were not used for training. Thus, users should push and hold a button while doing gestures. For implementing the user gesture recognition module, we utilized HMM-based open gesture recognition library [11] specifically developed for Wiimote.

4. ALGORITHM

To provide social media retrieval and intelligent information providing for a baseball, we proposed these algorithms: Social media indexing and point-of-watching recommendation.

4.1 Social Media Indexing

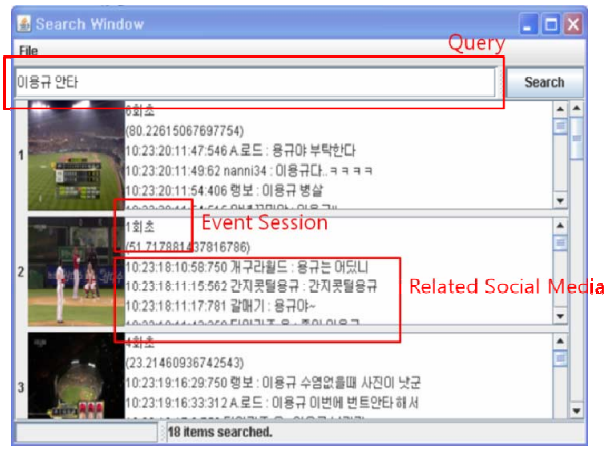

Figure 5. Screen dump of Event Retrieval

Users query a media server using keywords to retrieve corresponding events. For social media indexing, a baseball game is segmented into a sequence of event sessions; event sessions are divided by top and bottom halves. Each event session is enriched by social media, and is utilized for video indexing. In this system, two important features for indexing of video are used. The first one is based on term frequency and inverse event frequency (TF-IDF) features [9]. The term to be considered was extracted by

[2] Our gesture recognition module recognizes 4 actions: cheering with balloons stick, flag, drum, and card section

noun detection using POS tagging and named-entity recognition. TF-IDF features are used as a major term weighting measurement for matching a query with event sessions. The second one is a temporal feature of social media. The temporal feature describes how frequently terms are produced within a specific time and are utilized to normalize the similarity of a query and event sessions. A formula applying above two features was described in a below equation (1). $W_{t,e}$ means the weight of term t where an event session is e. Its performance and evaluation are beyond the scope of this paper, and we do not describe it in here.

$$W_{t,e} = Norm(f_{t,e}) \cdot log\ (1 + \frac{N}{n_t}) \qquad (1)$$
$$Norm(f_{t,e}) = f_{t,e} \cdot {}^{a}/_{t}$$

where $f_{t,e}$ is the frequency of a term t where event session is e
n_t is the number of event sessions
where a term t occurs more than θ[3],
N is the total number of event sessions.
a is the average of event sessions' elapsed time.
t is elapsed time given the event session

Figure 5 shows the screen dump of event retrieval based social media. Results are sorted by relevance scores of event sessions.

4.2 Point-of-Watching Recommendation

Point-of-watching recommendation module provides event-driven mostly relevant game history. People want to listen interesting information denoting interesting histories which they have not known before and want to know the context analysis from a different point of view. For example, if a player has unusual high hitting stats to a current pitcher, then the record will be displayed by our module. In addition, if he is waiting for the first ball, people may wonder how many home-runs were hit in his first at-bat. As in above examples, point-of-watching recommendation module plays a role of commentators and contributes to increase the understanding of current event context. For implementing this module, we constructed point-of-watching ontology to infer the most interesting history relevant to current context. The ontology was carefully designed by baseball experts, and subscribes play events of baseball as an input of ontology. The details of ontology design, its inference, and ranking methods are beyond this paper.

5. CONCLUSION

This paper proposed a new real-time event watching and sharing platform utilizing social media. This platform employs virtual mirror world and provides a social and tangible interface for baseball cheering system. The interfaces and mirror world encourage users to produce more social media by decreasing psychological distance among them and provide sharing environment. Social media contents are enriched by real-time event to be utilized for social media retrieval and point-of-watching recommendation. We tested our baseball cheering application in world baseball classic 2009 and 2009 championship series of the Korea baseball league. In this experiment, we confirmed that our platform promotes social interaction through interfaces for real-time social media consumption and revealed the usefulness for improving user satisfaction.

[3] In our system, θ was set as 3.

6. ACKNOWLEDGEMENT

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