ACTIVITY INFORMATION SHARING SYSTEM WITH VIDEO AND ACCELERATION DATA

Go Hirakawa
Network Application Engineering Laboratories Ltd, Fukuoka, Japan

Yuichi Hattori, Masato Nakamura, Sozo Inoue
Kyusyu Institute of Technology, Fukuoka, Japan

Keywords: Activity information, Accelerometer, Web service, Smart phone.

Abstract: In this paper, we introduce the large-scale activity information sharing system ALKAN2. ALKAN2 gathers users' activity information, which consists of three-axis accelerometer and video data using smart phones and web service. The information can be shared with other users, and their evaluations can also be gathered. In designing ALKAN2, we challenged 1) to diversify the types of activities, 2) to gather massive amount of activities, 3) and to motivate users to provide activity information.

1 INTRODUCTION

As pervasive computing evolves, human activity recognition technology is expected for various application fields, such as entertainment, healthcare, and agriculture. In entertainment, recognizing choreographies can help players' proficient. In healthcare, measuring lifestyle behavior of patients can be of help to prevent lifestyle-related diseases. In agriculture, recording work log of farmers can lead to improve workflow of cultivating process.

Previously, recognizing human activities required complicated equipment. However, the widespread usages of three-axis accelerometer equipped with mobile phones have opened the possibility of easy-to-deploy activity recognition.

Improving activity recognition requires a large number of activity data for various types of activities. However, gathering these data comes with difficulty, because these always conflict with motivating participants to perform activities and provide their information. Due to this difficulty, current human activity recognition technologies only support limited kinds of activities. (Bao and Initille, 2004).

In this paper, we introduce the large scale activity information sharing system ALKAN2, which gathers users' activity information with three-axis accelerometer on smart phones and video data, while providing participants' functionalities to share, mimic, and evaluate activity information.

In ALKAN2 system, we classify the user roles into 3 types, though a user can switch from any to any: "provider", "mimic" and "viewer". Providers upload activity data, which consists of accelerometer and video data to the server. Mimic mimics an activity that is uploaded by a Provider, and uploads the mimicking acceleration data to the server. Viewers watch and evaluate activity data of other users.

By these features, ALKAN2 has the following advantages:

1) It diversifies the target activity data by allowing participants to define activity classes by themselves. Expert-participants in various fields such as dance, medical work and agricultural work would create customized activities.

2) It inspires motivation of participants by being mimicked for Providers, automatically scored by similarity for Mimics, and evaluations by Viewers for both.

3) As a result of 1) and 2), it gathers massive amount of activity data including accelerometer and video data. In the remainder of this paper, we show related work in Section II, ALKAN2 system in Section III, discussion in Section IV, and conclude in Section V.

Hirakawa G., Hattori Y., Nakamura M. and Inoue S..
ACTIVITY INFORMATION SHARING SYSTEM WITH VIDEO AND ACCELERATION DATA.
DOI: 10.5220/0003411505570561
In *Proceedings of the 1st International Conference on Pervasive and Embedded Computing and Communication Systems* (SIMIE-2011), pages 557-561
ISBN: 978-989-8425-48-5

2 RELATED WORK

Activity recognition requires a large amount of training data such as labels and accelerometer data. There is already a work for gathering large-scale activity information by using the previous ALKAN. (Hattori et al., 2010). ALKAN can collect a large amount of accelerometer data and label data from mobile device such as iPhone/iPod Touch to the server. However, ALKAN does not bring a benefit to user, because ALKAN only has a feature of data gathering. In ALKAN2 system, every user can enjoy contents include movies, and contents provider can get response and reputation from other users, like as other CGM (Consumer Generated Media) system represented by YouTube or other video sharing system. Additionally, ALKAN cannot gather a broad spectrum of activities, because a user can only select from pre-set activities. In ALKAN2 system, we permit users to define actions that they want or require. This is because ALKAN2 can gather a broad spectrum of activities.

In the literature, Berchtold analyzes ten type of activity using mobile devices and a server. However, they analyze only three activities per attachment position. Berchtold et al. proposes a system for activity recognition service using mobile phones and cloud computers. (Berchtold and Buddle, 2010). The proposed system provides activity recognition service to mobile phones, as well as it evolves the recognition model gathering the data to the cloud computer.

Although our system does not provide activity recognition so far, we propose another kind of reasons to use the system for users by mimics of actions. Moreover, our system can also be extended to activity recognition service when the data are gathered massively. Thus, our system can be positioned as a new approach to gather training data for evolving recognition models.

3 ALKAN2 SYSTEM

Fig.1 shows ALKAN2 system overview. The system consists of smart phone software and information gathering server. In ALKAN2 system, users collect and upload acceleration sensor data with smart phones. They also record and upload video data through web browsers on client PCs. Users also watch activity data and make evaluations on them.

In ALKAN2, we gather information of where the smartphone is, such as waist, held in hand or in a pocket. If we gather an adequate amount of location information, we can recognise the location of smartphone from sensor data. Furthermore, we can recognise human activity regardless of its location.

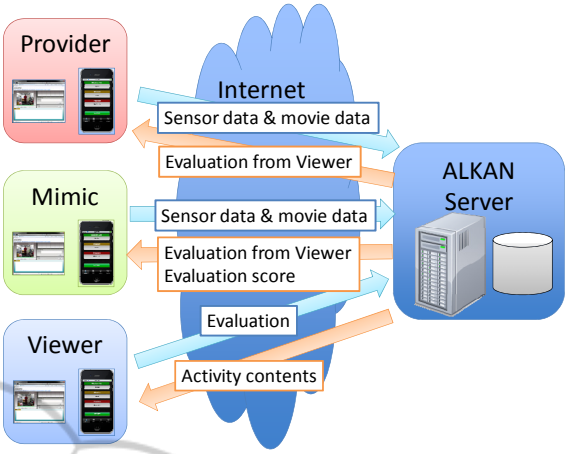

Figure 1: ALKAN2 system overview.

ALKAN2 system is suitable for gathering characteristic activity information, such as step of dances, forms of sports and other gestures, because everyone can valuate such activities with watching video of them. We apply ALKAN2 system to training of darts, practice of dance and training of manners. We also expect that we can apply ALKAN2 system to job training such as medical care, agricultural work and guidance of health care.

3.1 User Roles

In ALKAN2, we classify the user roles into the following 3 types, in which any user can switch to any role:

3.1.1 Provider

A user with role “provider” creates a new activity.

Firstly, Providers collect sensor data using a smart phone and records video using a camera. Then, uploads them to the server, and finally, binds the sensor and video data as activity information the Providers can receive evaluations of for the activity from Viewers.

We consider sports trainer, work instructor, and dancer who wants to bring her/his dance into vogue as Providers. They are valued their activity from many people, mimicked by Mimics as described later. Eventually, they can earn a reputation, and lead the trend in users’ community.

3.1.2 Mimic

A user with role “mimic” mimics activities uploaded by Providers.

Firstly, Mimics collect sensor data using a smart phone. Video data can be optionally recorded. Then, s/he uploads and binds the data as other activity information. S/he can also receive evaluations from Viewers.

We consider sports trainee, intern, amateur dancer, and follower of Providers as Mimics. They watch contents provided by Providers, which include example video of activities, and mimic the activities with recording accelerometer data. Eventually, they can recognize their progress in these activities.

3.1.3 Viewer

A user with role “viewer” watches activity data on the web browser on a client PC.

S/he gives numerical and/or commentative evaluation to shared activities.

We consider people who just enjoy contents with activity video as Viewers. The more ALKAN2 system gathers attractive contents, the more this system gains the Viewer. As a result, Providers and Mimics get response and reputation for their contents, which motivate them to create new contents. We also expect Viewer to grow up to Mimics or Provider.

3.2 Data Binding

In ALKAN2 system, an activity information data accepts multiple accelerometer data and video data to support variety of recording data situations such as multiple cameras and multiple sensors. Therefore, the system provides the functionality to “bind” multiple data as single activity information.

3.3 Smart Phone Software

Smart phone software runs on iOS which supports iPod Touch, iPhone, and iPad, and on Android OS. Fig.2-3 shows sensing interface with the smart phone software. At first, a user selects a type of activity, then selects the sensor position, and then starts sensing with performing activity. The sensor data and the metadata are stored in the memory on the smart phone. Finally, the smart phone software sends these data to the server when it becomes online.

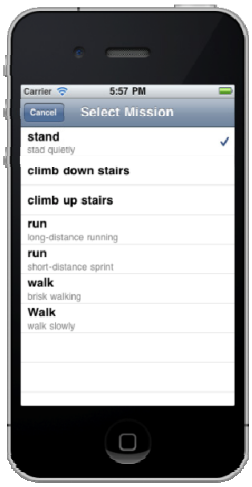

Figure 2: sensing interface. Figure 3: Selecting activities.

3.4 Server

As shown on Fig. 4, information gathering server has the following features.

3.4.1 Activity Definition

Providers create new activity definition using web browser on client PCs. The term “activity” consists of activity name, description, and value of METS (metabolic equivalents).

3.4.2 Activity Management

Providers and Mimics upload and associate video data and accelerometer data with activity definition using web browser on client PCs. They also create list of activity, and allow accessible to other users.

3.4.3 Activity Information Storage

Mimics record and send mimicked sensor data to server software using smart phone software. Server software stores activity data on database.

3.4.4 User Management

All users register their authorization data using web browser on client PCs. Smart phone software also use this authorization data for personal verification.

Information gathering server consists of Apache as web server and MySQL as database server. Fig.5 shows the view of activity information with client PC. The browser view of activity information in ALKAN2 shows video data, accelerometer, and evaluations by Viewers.

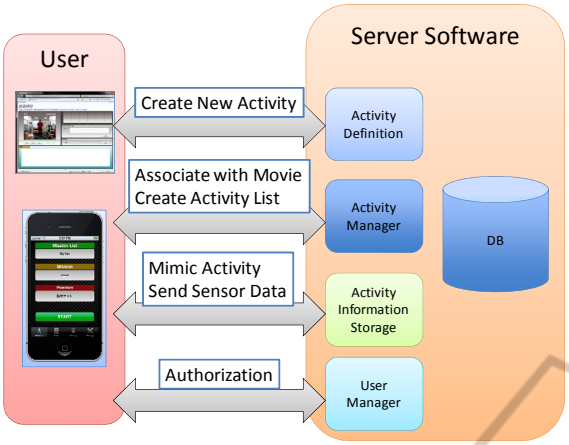

Figure 4: Feature of Information Gathering Server.

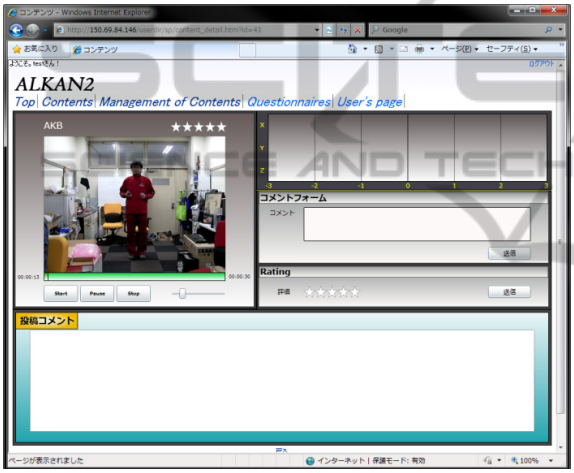

Figure 5: View of activity information with client PC.

4 DISCUSSION

In ALKAN2 system, we classify the system user into 3 roles. Providers can create an activity of her/his interest, or specialties. This leads not only to diversify the type of activities, but also to upgrade the quality of activity data.

Viewers can browse many activity data with video data uploaded by Providers and Mimics for free. High-quality activity data will attract Viewers, and will receive good reputation. These reputation and response from Viewers motivate Providers and Mimics to upload activity data continuously. (Bruke, Marlow and Lento, 2009). As a result, ALKAN2 system benefits massive amount of activities uploaded by Providers and Mimics. Consequently, we suppose this cycle brings positive growth in gathering activity data. Thus, ALKAN2 system fits in gathering large-number of activity data for various types of activities.

On the other hand, ALKAN2 system is suited to gathering characteristic activity information, such as dances, sports and gestures, rather than daily habits of activity information, because ALKAN2 system motivates users to upload activity data by reputation and response from other users. Gathering activity information of such daily habits is an issue in the future.

ALKAN2 system requires a PC client as well as smart phone client to register activity data, to upload video data, and to associate them. Registering activity information without PC clients is also an issue in the future.

5 CONCLUSIONS

We introduced the large-scale activity information sharing system ALKAN2, which can share and evaluate human activity information. Moreover, we challenged to diversify the types of activities, to motivate users to provide activity information, and accordingly, to gather massive amount of activities.

We have already started experiments using the evaluation system consists of more than 200 ALKAN2 clients installed on iPod Touch. Moreover, we are releasing ALKAN2 system to everyone, and willing to expand experiments globally.

ACKNOWLEDGEMENTS

This work is supported by 'Information Explosion IT Platform' (21013038) by the Grand-in-Aid for Scientific Research, Grant-in-Aid for Young Scientists (A) (21680009) of JSPS, and Strategic Information and Communications R&D Promotion Programme (092110002) of MIC, Japan. We are grateful for their support.

REFERENCES

Ling Bao and Stephen S. Intille. (2004) '*Activity Recognition from User- Annotated Acceleration Data*', International Conference on Pervasive 2004, pp.1–17.

Nishkam Ravi, Nikhil Dandekar, Preetham Mysore, and Michael L. Littman. *Activity recognition from accelerometer data.* In AAAI, pages 1541–1546, 2005.

Yuichi Hattori, Masaki Takemori, Sozo Inoue, Go Hirakawa, Osamu Sudo, *"Operation and Basline*

Assesment Large Scale Activity Gathering System by Mobile Device", DICOMO2010, pp.583-590, Jul, 2010.

Yuichi Hattori, Sozo Inoue, Go Hirakawa, Osamu Sudo. *"Gathering Large Scale Human Activity Information Using Mobile Sensor Devices"*, International Workshop on Network Traffic Control, Analysis and Applications (NTCAA-2010), pp.708- 713, Fukuoka, Japan, 2010.

J. Lester, T. Choudhury, N. Kern, G. Borriello, and B. Hannaford. A hybrid discriminative-generative approach for modeling human activities. In Proc. of the International Joint Conference on Artificial Intelligence (IJCAI), 2005.

M. Berchtold, M. Budde, D. Gordon, H. R. Schmidtke, and M. Beigl. *"Actiserv: Activity recognition service for mobile phones"*, In Proceedings of the Fourteenth International Symposium on Wearable Computers (ISWC 2010), 2010.

Burke, M., Marlow, C., and Lento, T. *Feed me: motivating newcomer contribution in social network sites.* In Proc. CHI '09. ACM Press (2009), 945-954