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A Design of WBAN Data Integration System for the HL7-based patient management

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Abstract

Recently with the development of IT technology, the medical technology have been developed in various ways. Among them, WBAN can check the state of the patient in real time. However, the data generated by these techniques have a problem that they have heterogeneous properties depending on the type of sensors and devices. In this paper, we proposed a method using meta repository as a way to provide the sensing data of WBAN for the health care system by integrating along the HL7 standard item.

Keywords: WBAN (Wireless Body Area Networks), Meta Repository, HL7 (Health Level 7), Schema Mapping

1. Introduction

WHO(World Health Organization) predicts that the people over 60 years old will reach about 2 billion people and will be more than doubled in the 1990s. The problem of an aging society is the spread of chronic diseases. This will result in a number of problems [1]. It will require much cost because we need more doctors, hospitals, home care professionals, and hospital facilities.

IT technology has been developed rapidly in recent years. Especially, the development of the communication device, variety of a portable information terminal, and wireless local area network technology give a great effect on the medical field. One is like Bluetooth, Wi-Fi, 3G and LTE and the other is same as PDA, smart phone [2][3]. Patient's data, which is checked by a sensor, is transmitted using Bluetooth wireless communication protocol and the doctor can see the status of the patient continuously [4]. This system can

continuously measure the body to provide the user's biological signals. This environment is called WBAN [5][6][7]. But this collected data has the problem of heterogeneity depending on the type of sensor and the type of device that detects. In this paper, we propose a method for integrating the collected data based on a HL7 standard.

This paper is organized as follows. Section 2 describes the ways to integrate a sensed data. Section 3 describes the configuration and elements of the proposed system. Section 4 describes the conclusion.

2. Integration plan for the sensing data

This system used BT-LE network as a standard for WBAN. The basic specification of BT-LE protocol is EEE802.15.6. We propose a data integration method that can be used in the data processing unit, such as a HIS.
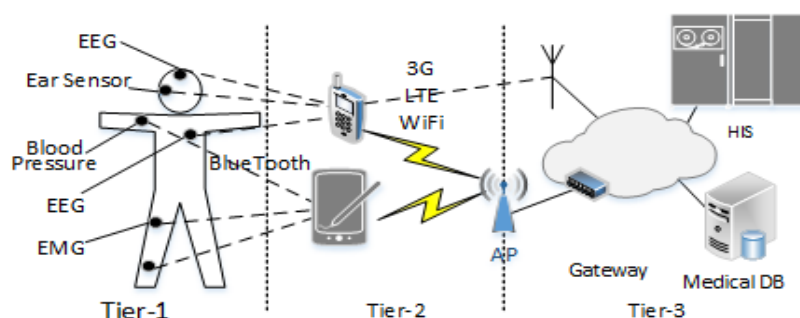

Figure 1. A 3-tier architecture based on a WBAN

Fig. 1 is the basic 3-tiered structure of WBAN. Biological information is detected by a sensor in the Tier-1. The data is collected through the Tier-2 terminal and stored in medical information system of Tier-3 or in medical database for medical service. To perform integration, mapping is carried out for each standard and sensor in the manner of 1:n for a standard and sensor.

Fig. 2. A Collected Sensing Data

Figure 2 shows two examples of data which is transmitted from mobile device to HIS that is collected by the sensor. Entries of (a) and (b) have approximately the similar structure. However, it shows a difference in sensing item depending on the sensor manufacturer or production time. There is a difference when we use acronym, such as the Minimal/Maximal Blood Pressure of (a) and the Diastolic/Systolic Blood Pressure of (b), the Skin Temp and (a) the Body Temperature of (b). Temperature has a difference in the unit, such as Celsius (℃) and Fahrenheit(˚F). This problem that occurred in this way can be solved by performing data mapping of sensor data based on standard entry. The system for this is described in the next section

3. The proposed system

In this paper, we proposed an integrated system for accumulating in the HIS to collect data sent from the WBAN. The proposed system is configured as shown in Figure 3, and the role of each element is as follows.
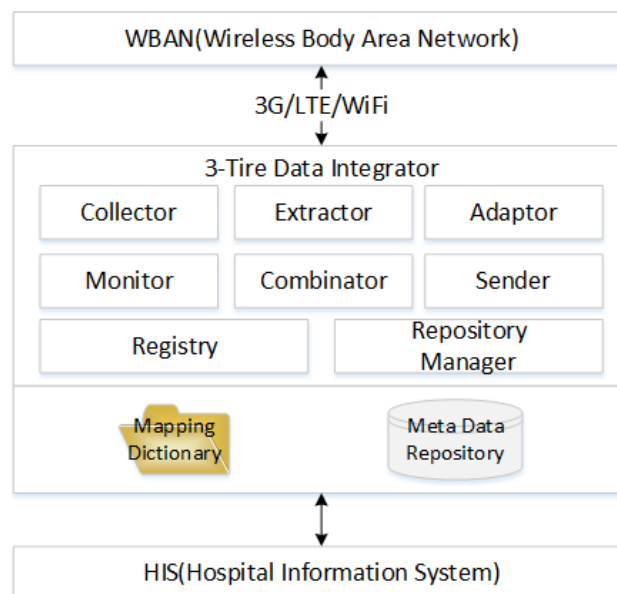

Figure 3. A Proposed System Architecture

- Collector: Collect the sensing data collected by the wireless mobile unit.
- Extractor: Extract biometric information from the collected data at the Collector.
- Combinator: Combine the extracted data using the Meta Data Repository and Mapping Dictionary.
- Adaptor: Conversion is made to meet the required system.
- Sender: Transmit the converted data to the HIS.
- Monitor: Perform an audit and management to collect sensing data.
- Registry: Register the updated mapping information
- Repository Manager: Manage MetaData Repository for Mapping Dictionary.

Organically combine each element to the above, this system solves the problem of data heterogeneity generated from the sensor.

4. Conclusion

The proposed system solves the problem of heterogeneity in the sensed data generated by WBAN, which can be applied to the development of medical technologies according to the development of sensing and network technology. We propose a method of integrating the meta information in accordance with the standard as a way to integrate efficiently. It is possible to minimize the number of cases of the mapping by integrating sensed data based on the standard of this technique. This system has the advantage of providing the consistency of the data processing by performing the data transfer between the systems on the basis of a standard entry regardless of the existing sensor. In the further study, we will research on the independent system that can adapt to new computing environment without changing the existing system.

References

[1] Hommersom, A., Lucas, P. J., Velikova, M., Dal, G., Bastos, J., Rodriguez, J., & Schwietert, H., "MoSHCA–.My Mobile and Smart Health Care Assistant.", 2013 IEEE 15th International Confernce on e-Health Networking, Applications and Services, 2013. pp.188-192.

[2] Emil Jovanov, "Wireless Technology and System Integration in Body Area Networks for m-Health Applications", Proceedings of the 2005 IEEE Engineering in Medicine and Biology 27th Annual Conference Shanghai, China, September 1-4, 2005. pp.7158-7160.

[3] Jianchu Yao, Schmitz R., Rarren S., "A wearable point-of-care system for home use that incorporates plug-and-play and wireless standards," IEEE Transactions on Information Technology in Biomedicine, vol 9, issue 3, Sept. 2005. pp 363-371.

[4] Latré, B., Braem, B., Moerman, I., Blondia, C., & Demeester, P., "A survey on wireless body area networks." Wireless Networks, vol 17, issue 1, 2011. pp.1-18.

[5] Chen, M., Gonzalez, S., Vasilakos, A., Cao, H., Leung, V. C., "Body Area Networks: A Survey," Mobile Networks and Applications, vol.16, issue 2, 2010. pp. 171-193.

[6] Kalyani Divi and Hong Liu, "Modeling of WBAN and cloud integration for secure and reliable healthcare",Proceedings of the 8th International Conference on Body Area Networks. ICST (Institute for Computer Sciences, Social-Informatics and Telecommunications Engineering), 2013. pp.128-131.

[7] Jung, J., Ha, K., Lee, J., Kim, Y., Kim, D., "Wireless body area network in a ubiquitous healthcare system for physiological signal monitoring and health consulting," International Journal of Signal Processing, Image Processing and Pattern Recognition, vol.1, issue 1, 2008. pp. 47-54.