Journal of Engineering and Applied Sciences 14 (Special Issue 1): 3954-3957, 2019
ISSN: 1816-949X

Smart Healthcare Applications for Human Life-Care

Peom Park
Department of Industrial Engineering, Ajou University and Humintec, Gyeonggido, South Korea

Abstract: Smart healthcare and biomedical informatics application system will be a major big data platform for the healthcare and medical information systems in the human wellness life service. With the wellness big data resources in the healthcare service with human life-care hospital network environment, smart digital biomedical system will be growing and taking the next generation model for the human information management system beyond electronics and software solution in the next generation healthcare. Three parts in the data collection situation are medical disease data, personal genomic data and life log data from the smart wearable devices with some vital data. Various types of disease data will be taken from medical information system in hospital to cope with healthcare resources and patient's symptom involving different platform related services. Biomedical informatics platform and smart agent as Clinical Decision Support System (CDSS) will be extended to produce some activation to this service. Smart health avatar assisted and cooperated with these data resource to deal with personalizing precision and preventive forecast solution for the future healthcare service environment. Some cases of this coming situation in the ubiquitous life care prevention, the u-Healthcare, u-Silver and smart health avatar in the biomedical informatics systems can be shown as some configuration and analyzed feature with verified systems during these days.

Key words: Smart ubiquitous healthcare, biomedical informatics, health avatar, CDSS, u-Healthcare, personal geonomic data

INTRODUCTION

Smart healthcare is a medical advanced network model for applying intelligent ubiquitous technology to the health industry to improve the efficiency of prevention, diagnosis, treatment and patient care and to overcome limitations and problems of healthcare business.

In addition, telemedicine services and u-Healthcare can be combined with ICT technologies to provide appropriate health care securely anytime, anywhere. Furthermore, it is possible to recognize the situation in medical work environment and to build intelligent autonomous monitoring by using medical health knowledge and to aim service integration construction system in which the situation is self-growing from the patient's life log data and the real-time cumulative information of the environment.

Smart ubiquitous health service is classified as u-Medical (Providing services to prevent, diagnose, treat and manage disease in patients), u-Silver (Home care, nursing, safety management and living support services) and u-Wellness (providing quality of life improvement services such as diet, exercise and health care), depending on the user's purpose (Park, 2015). As such current health care, life log big data informatics and social-lifecare networks are also available to accurately identify the needs of diverse users and provide the advanced services and utilize them for smart health services (Jan-Hoe *et al*., 2001).

MATERIALS AND METHODS

The purpose and needs of u-Healthcare: The biggest driving force that u-Health has enabled in the next generation growth industry is the change of medical system paradigm due to wellbeing aging society and growth of medical welfare industry market. Korean population structure will be estimated that the proportion of elderly people will increase from 7.2% in 2000-14.3% in 2018, 20% in 2025 and more than 37.4% in 2050. As a result, the cost of medical insurance for the elderly will amount about one-third of total medical expenses. As the population ages in the future it is expected that medical expenses will continue to increase due to the rapid increase in the use of medical services and citizen with chronic disease. Therefore, the need for smart healthcare has been emphasized in countermeasures against the ineffective increase in national health expenditure (Dogmin and Shin, 2013). The aim of smart u-Health is to maximize the social and economic effects of economic and industrial ripple effects such as reducing medical costs and socio-economic costs, public health service and preventive care and infectious diseases (Jeong-Min *et al*., 2009).

Smart healthcare is aimed not only to reduce medical costs but also to change the consumer paradigm from medical treatment to preventive center and to change consumer's recognition and treatment-oriented provider centric service to patients-oriented and active service. In addition, healthcare can be based on more specialized genetic information than family history. Medical knowledge is not only dependent on doctors and hospitals but also spontaneously searches and shares open resource data through social network. Health informatics platform can be obtained and experienced spontaneously by knowledge participation and network (Tolentino and Park, 2010).

Smart healthcare technologies and services: The major technologies and services of smart health are aimed at sharing, communicating and participating services using informatics data in many areas. There are some critical technologies such as AI with machine learning and deep learning, block chain with security, user experience interaction to deal with human data resources in this life care industry. Also, from the genomic project analyzing the nucleotide sequence of the genome, the medical big data era has come to be able to provide u-Health services. Big data analysis mining and predictive agents as a means to harness massive amounts of inherited patient genetic information (3 billion pairs of nucleotide sequences, 10 million specific mutation information, 3 MB extraction computing from 150 TB in case) and accumulated acquired disease information (NCRC's Health Avatar, etc.) have been able to present and prevent personalized treatments depending on the patient's situation. Thus, medical informatics can provide more useful data resource to patients (consumers), suppliers (doctors, hospital clinics), payers (insurers, governments, employers) which increases the accuracy and timeliness of information and give insight and ultimately, build an improved health care system. A simple example is shown as: Big data combined with the convenience of smartphones collects medical information, manage and prevents chronic diseases, diabetes, heart disease and asthma. Providing consumers with an incentive to take care of their health can help ease illnesses. Risk analysis for disease development through geno-type: in the United States, somatic cell genes in saliva are analyzed and sell kits to proactively inform of diseases about certain illness. It is laying the groundwork for personalized medicine by accumulating customer data. Research and performance using big data from global network.

Using the information presented in the medical service as shown in the example above, one can see that a variety of services are available. Then, let's find out what kind of service is currently being provided in Korea and what key technologies are being used to provide it. The services to be introduced below are the u-Health research team at the UCN ubiquitous frontier project and as a model of a national health pilot project and as a commercial operation model based on the National Health Service. As the legislation of the remote telemedicine is delayed, the business model is still stagnant.

RESULTS AND DISCUSSION

Smart healthcare and lifecare service case: The right picture of Fig. 1 is the representative model in case and it was the service model that the Ministry of Health and Welfare promoted. It is a service to carry out telemedicine by connecting u-Silver for elderly people, u-Wellness (home health care service) and u-Medical (telemedicine service) to smart u-Healthcare center and hospital medical institutions. This service provides telemedicine, visiting nursing and home health care services. In the left picture of Fig. 1, S-Care includes smart care service center in existing u-Health. This provides ICT-based facility/system to patients free of charge for enhancing private role and

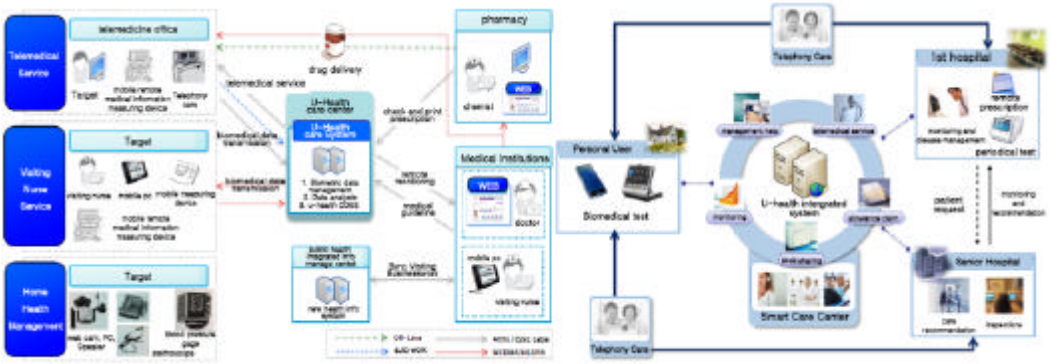

Fig. 1: Smart healthcare service (L) and S-Parent/u-Silver service (R)

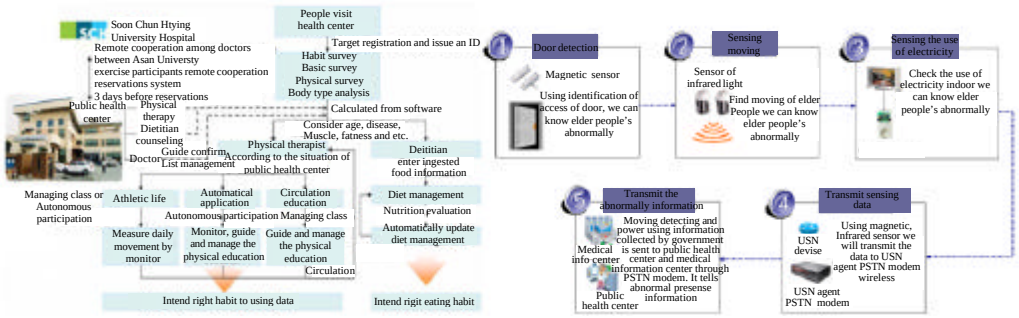

Fig. 2: Smart u-Life habit management service (L) and the safety management system for senior citizens who live alone (R)

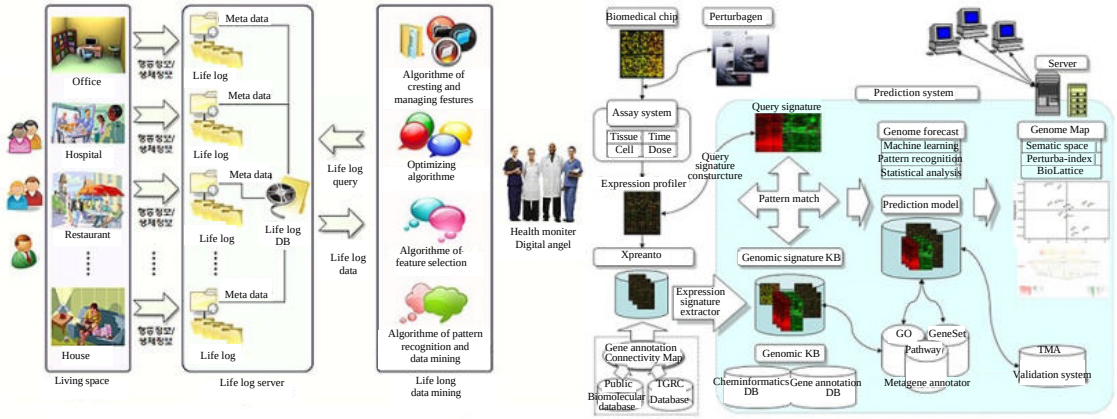

Fig. 3: Life log data mining health monitor (L) integrated modeling disease outcome system (R)

healthcare, provides information communication between doctors and consumers through the smart-care center and consultation with medical institutions.

Figure 2 is a smart u-Lifestyle management service and living alone elderly safety management system. The smart u-lifestyle management service is a customized diet and exercise management system for chronic patients and high-risk people including the general public. This provides food and exercise method that meets the characteristics of the user induces balanced eating habits and motivates users to meet the required amount of exercise. This service which was run at C-Hospital of S-University was a great help for the health care and medical care of the chronic patients. The elderly health care service for the elderly is a service for the prevention of diarrheal diseases and emergency of the disabled elderly and health care management. Biometric information is transmitted to the u-Health center through the tele-network and the Internet and cumulatively managed this center provides counseling service. Although, it is a service based on sensor it has a disadvantage of initial cost but it has attracted much attention because it can accurately determine patient information in real time.

Also, it is shown the u-Health ADHD collaborative prediction system and smart safety healthcare occupational disease monitoring system developed by IE, A-University and H-Company, etc. The primary function of 3-axis acceleration sensor, RFID and intelligent Attention Deficit Hyperactivity Disorder syndrome (ADHD) is online preliminary service which was used to provide preliminary examination at some elementary schools in G-do Province. In addition, a sensor for various industrial safety and health hazards was installed at the work sites of some automobile parts factories in H-city, G-Province and a real-time work environment epidemiological survey was conducted. In the Department of Occupational Medicine at A-University Medical Center and at A-Central Industrial Hospital, a pilot system of occupational health and occupational disease monitoring system was established in conjunction with occupational disease occupational health checkups.

The left figure in Fig. 3 is a service that stores information in the living space in the life log and provides health information about the life pattern or characteristics by data mining stored information. Users can monitor their

health status from day to day using life log as well as get professional advice from life log information. The right picture is a disease prognosis prediction system based on integrated modeling of genome information and clinical information. By establishing a systematic integration repository of bio-genome information and clinical information, we can inform the patient that he is vulnerable to a specific disease or predict the time it will take.

CONCLUSION

Domestic u-Healthcare in Korea with last u-City and smart city national project are currently under review to revise related laws and systems in accordance with the three areas of telemedicine, health information management services and personal information protection laws. Current medical law does not recognize direct telemedicine between doctors and patients. It does not allow much of the facilities and equipment requirements of telemedicine as well. However, as described above, u-healthcare is a fostering growth industry that creates high value-added and knowledge-based employment based on a smart remote platform that integrates core ICT technologies of the future. Therefore, u-Healthcare can be an effective solution to an aging society. Legislation must be resolved urgently and competitiveness must be secured in the global medical service industry. In u-Healthcare, there are situations that need to be solved as well as mitigation of related laws and systems. The above problems must be solved in order to activate u-Healthcare such as the inconvenience and reliability problem of core medical devices and sensors, lack of global standardization of service platform, lack of linkage with medical institutions and patient safety.

u-Healthcare service can dramatically reduce social complaints and costs due to visits to medical institutions and improve the quality of medical services through remote/on-the-spot monitoring and accumulation of medical health care services. In addition, the activation of the ICT convergence u-Healthcare service system is effective in the re-entry rate of chronic disease, the number of visits to emergency rooms, hospitalization costs, mortality rate, response to infectious diseases industrial safety and health problems, misuse and misuse of drugs. It will be able to adapt and utilize it.

ACKNOWLEDGEMENT

This research is supported by the KHIDI-MOHW AI Project, “AI Pathology Diagnosis CDSS and Open Informatics Platform”.

REFERENCES

Dongmin, S. and D. Shin, 2013. Development of a u-Healthcare system for people with dementia. Korean Telecommunications Association, South Korea.

Jeong-Min, Y., Y.M. Shin and P. Peom, 2009. In-USN-based environmental monitoring system guide for availability. Korea IT Service Industry Association, Korea.

Jun-Hoe, E., R.W. Park, K.H. Han, H.Y. Byun and P. Peom, 2001. Study on the development of web-based pathology alliance system. Korea Global Healthcare Association, Korea.

Park, P., 2015. Telemedicine and u-health service models. Inland Empire Magazine, Southern California, USA.

Tolentino, R.S. and S. Park, 2010. [A study on u-healthcare system for patient information management over ubiquitous medical sensor networks (In Korean)]. Intl. J. Adv. Sci. Technol., 18: 1-11.