International Journal of Engineering and Technology Innovation, vol. 2, no. 3, 2012, pp. 216-225

Applications of Health Management Using Android and RFID

Young-Long Chen[1,*], Xiao-Zhu Shi[2]

[1,2]Department of Computer Science and Information Engineering, National Taichung University of Science and Technology, Taichung, Taiwan

Received 15 May 2012; received in revised form 13 June 2012; accepted 05 July 2012

Abstract

Health management has become increasingly important in personal health care in modern life. The system we have designed, which provides a method to help facilitate health management through an associated smart phone with Radio Frequency Identification (RFID), which is a new type of application. This system consists of medical knowledge and health management. In the application of medical knowledge, we use the human model as well as the operation of RFID to obtain medical knowledge concerning human organs. The two main functions of the health management system are medication reminders and drug identification. The feature of medication reminders allows users to set the time for taking medication so that patients do not miss taking their medication. The feature of drug identification allows the operators to identify the drugs and can let the users know who needs to take drugs. In addition, we have designed a web page that allows users to understand their health status.

Keywords: RFID, Android, health management

1. Introduction

Currently, the smart phone's [1] capacity for multi-functions is emphasized, while offering the convenience of being small, power saving, easy to carry, etc. Chen et al. [2] proposed a distributed fixed-step power control algorithm with binary feedback via window concept for cellular mobile systems that power control algorithm can reduce energy consumption for smart phones. Almost following the pace of the computer, the smart phone has become increasingly ubiquitous, with almost everyone having an android [3-4] smart phone; it has gradually become a necessity. A busy, hectic life leads to a decline in health. We therefore have designed the smart phone function to keep the user' aware of his/her state of health, by providing information concerning such things as BMI [5-6] measurement, dietary advice, heat statistics, etc.

Many diet-related diseases of modern-day civilization, such as obesity [7], hypertension [8-10], diabetes, and liver and kidney dysfunction, have begun to affect our health. Many people need to rely on drugs to control these diseases. Therefore, different drugs need to be taken at different times, but some drugs cannot be taken at the same time. ALSO, older people or people with disabilities may forget to take their medicine. Such individuals can use this health management system to remind their helper/care-giver about their medication schedule, exactly when they must take their medicine. When a patient cannot take his/her medicine immediately or identify the drugs, the helper can help. Thus, the smart phone function assists not only with medication safety but also with health safety.

* Corresponding author. E-mail address: ylchen66@nutc.edu.tw

Tel.: +886-4-22196621; Fax: +886-4-22196341

In recent years, the smart phone has become increasingly popular. Statistics show that, based on the 37.9% current annual growth rate of smart phone use, by 2015, one of every two cell phones will be a smart phone. The combination of e-books and smart phones has become popular; therefore, in order to assist instruction, we have designed a simple medical e-book combined with the RFID [11-12] identification function. This uses the RFID tag to identify the human organ of interest in order to improve general health through medical instruction.

In generally, individuals over age 65 have a higher proportion of combined chronic diseases and need to take medicine for a longer time. Taking as an example the 2007 findings of the Bureau of Health Promotion concerning the living status of Taiwan's middle-age, we found that 88.7% had more than one chronic [13-14] disease conditions; 71.7% had two or more diseases; 51.3% had three conditions. Diseases such as hypertension (46.7%), cataracts (42.5%) and heart disease (23.9%) were the most common. Many people generally take multiple medications, but the more drugs taken, the greater the probability of side effects. Our survey showed an adverse effect of drug using in 6% of those using more than two drugs; an adverse effect in 50% of those taking more than five drugs; and an adverse effect in 100% of those taking more than eight drugs. The elderly show poor medication compliance. This means that they do not comply with the instructions that accompany their prescribed medicine, such as mixing drugs, taking other drugs at the same time, not taking their medicine on time, etc. This situation often leads to the disease being difficult to control. Thus, a system of personal care must be designed to remind the individual about the time for taking his/her medication, as well as identifying the drugs to be taken. As a result, not only can the system assist the elderly with prolonged medication treatment but also at the onset of heart disease or asthma, the family can immediately use the drug identification feature to help the patient. The system is mainly based on the teaching of medical knowledge in conjunction with personal passport.

Medical knowledge enhances the understanding of disease and the knowledge prevention; it also can be used in the instruction of health, and medical assistance. The content is described by simple emphasis, with the graphics of the related organ to enhance the information contained in thick medical books. The contents of conceptual orientation go deep into the different stages of learning, making medical knowledge seem like common sense. Furthermore, it can use the human organ conditions so that everyone is able to understand organ-related diseases, the organ, and how to dry-nurse.

Health management uses the RFID sensor to tag items, for example, pharmaceuticals and the medical box as long as items are identifiable by a tag, we can refer to the drug manual to identify their proper use. An advantage of this is that it can remind the user to take his medicine and identify the drugs with RFID; it can also avoid duplication of medication, medication errors, etc. Furthermore, personal passport is an extension of the homecare system. When the patients have a sudden illness and are unable to obtain drugs or unable to identify the drugs they require, the system enables others to identify the drugs and establish a healthy-related website that can record the user's most recently measured body temperature, blood pressure and pulse, thereby enabling users to manage their own health [15-16].

2. Our proposed architecture

The platform of system design consists of Android and RFID. With regard to the Android aspect, the design direction focuses on diet and exercise. With regard to the RFID aspect, the design direction focuses on medical knowledge and the body's health. The architecture of the Android system is shown in Fig. 1. The Android system consists of four components: BMI measurement, and dietary advice, heat statistics and tracking exercise-related caloric consumption. RFID established a passport e point with two main functions. One is medical knowledge teaching and the other is health management. Health management includes the medication-reminder component and drug identification. The system architecture is shown in Fig. 1.

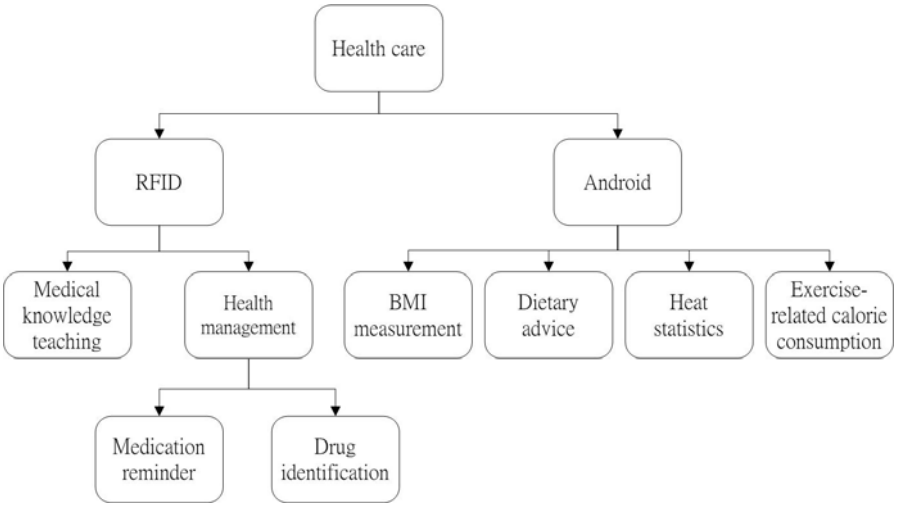

Fig. 1 The architecture of health management with Android and RFID

3. Design of functions

The platform of system design consists of Android and RFID. The system of Android and RFID is described as follows.

3.1 Android

The Android system consists of four components: BMI measurements, dietary advice, heat statistics and exercise-related caloric consumption. BMI measurement is used in measuring the human health exponent; dietary advice is used in providing the dietary considerations; heat statistics are used in controlling the calories from food; and exercise-related calorie consumption pertains to how many calories are consumed daily by physical exercise.

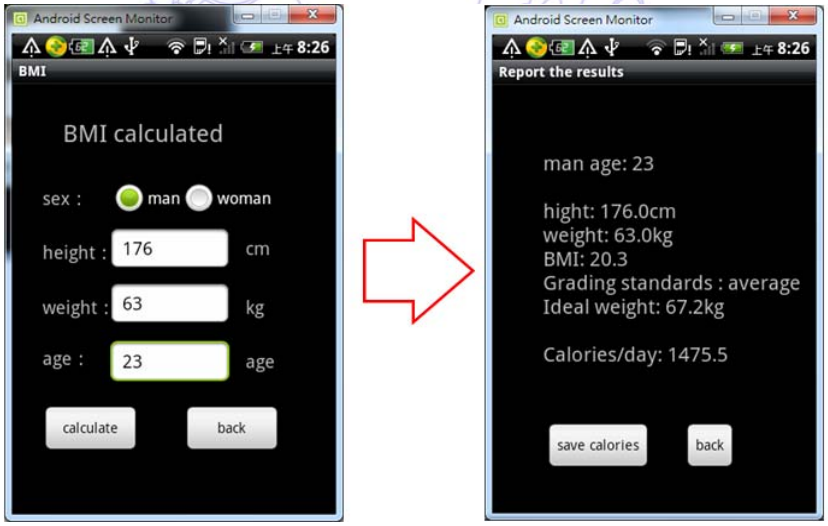

Fig. 2 BMI Measurement

3.1.1 BMI measurement

Body mass index (BMI) is lets the user input the measurements of height and weight, and then use the formula of BMI=weight/ (height × height) to obtain BMI; height is divided by 100. Then the user can determine whether or not he/she is obese. This calculation is shown in Fig. 2.

3.1.2 Dietary advice

Dietary advice is lets the user to choose the advice; this is shown in Fig. 3. For a user with an illness, the main screen will list all the dietary advice for this illness. Furthermore, it will provide the dietary considerations to prevent the user from eating the wrong food.

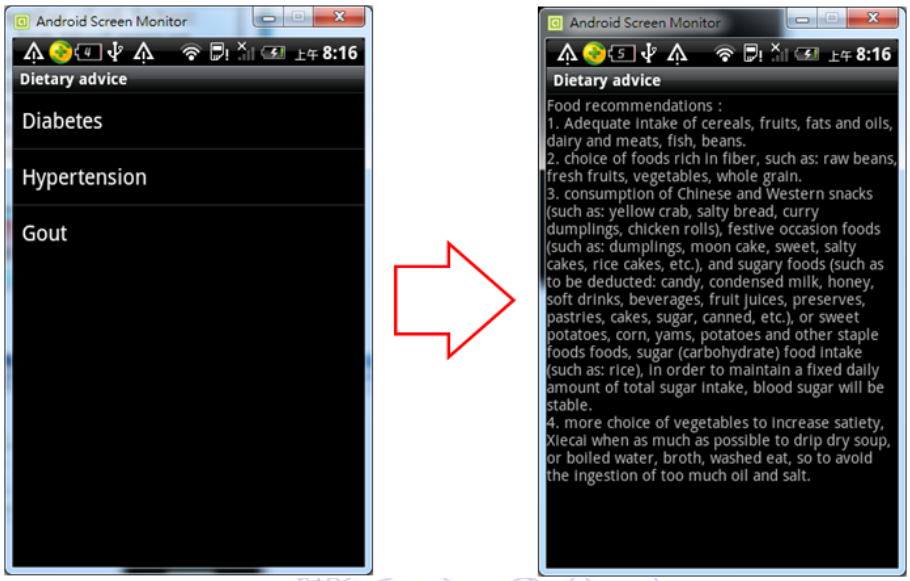

Fig. 3 Dietary Advice

3.1.3 Heat statistics

At dinnertime, people begin to ask others what they would like to eat. If the user fears becoming fat, he/she can use the heat statistics to answer wisely with a healthy choice. The system lets the user choose what to eat, and provides him/her with the total calorie count of this choice, important information in the context of calorie intake, consumption and management. This is shown in Fig. 4.

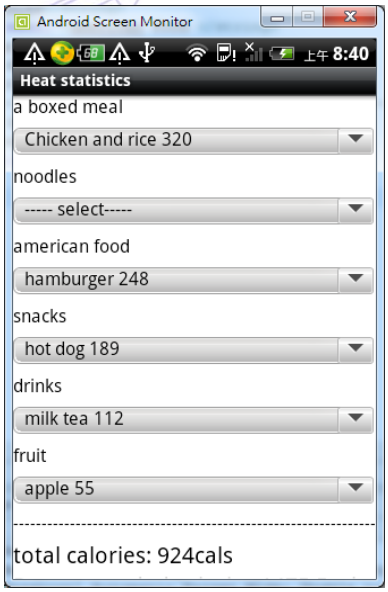

Fig. 4 Heat Statistics

3.1.4 Exercise-related calorie consumption

When the user wants to know how many calories he/she has consumed, the system can calculate use the kinetic energy and show the mileage, time and how many calories have been consumed. The system also shows the calories consumed for the day. This is shown in Fig. 5.

Fig. 5 Exercise-related calorie consumption

3.2 RFID

We use the HP IPAQ 212 to design these functions; the picture is shown in Fig. 6. HP IPAQ 212 is equipped with the reader, as shown in Fig. 7. The HP IPAQ 212 can identify the item with a tag, as shown in Fig. 8. The tag is divided into two types: the card tag and the coin tag, as shown in Fig. 9.

RFID comprises of two parts: medical knowledge teaching and personal passport. The personal passport is divided into two parts: medication reminder and drug identification. Medical knowledge teaching is used in teaching the users medical knowledge. The personal passport is used in managing the individual's personal health status. The medication reminder is used to remind the user when to take his/her medication. The drug identification feature is used to identify the drug name.

Fig. 6 HP IPAQ 212

Fig. 7 Reader of HP IPAQ 212

Fig. 8 Tag of card

Fig. 9 Coin tag

3.2.1 Medical knowledge teaching

In order to provide users with the ability to query quickly, we can use the function of RFID to identify the Human Body Model. As long as the relevant parts are identified, the system will display the relevant medical knowledge.

Medical knowledge teaching is provided in a simple medical e-book that we designed for the patients; it uses the RFID identification feature to assist with instruction in a way that differs from the general medical e-books. This system does just the conceptual to import, with the RFID identification function for the model identification of human organs to provide effective instruction. The user can use employ the RFID sensor module with a human organ model after pasting the RFID tag on the model of the human organs; it can then employ the RFID sensor module to obtain the position of the tag that includes basic information about the organ, diseases that may affect the organ how to prevent these diseases, etc. In order to assist with instruction, we combine the six systems, letting the user see the related information of the six systems on the machine. This is shown in Fig. 10.

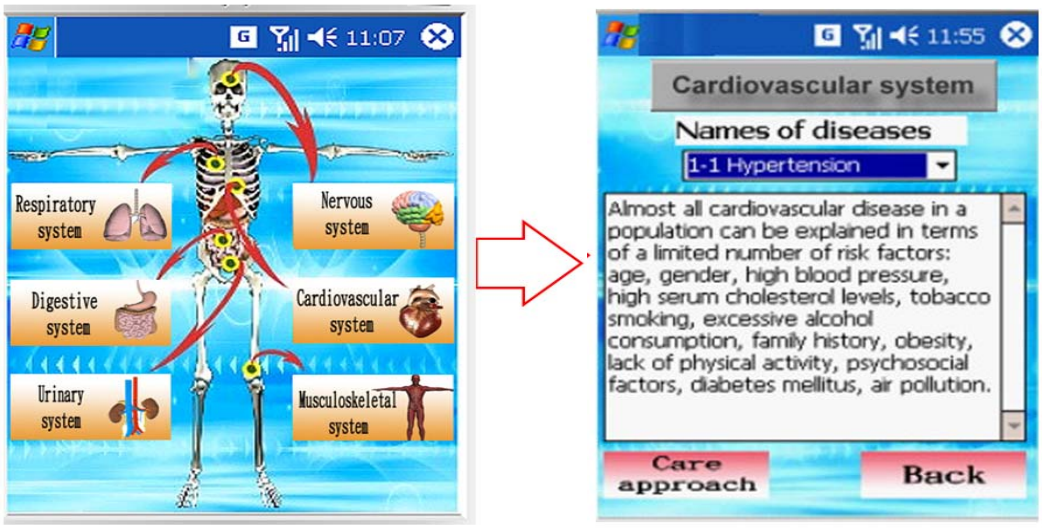

Fig. 10 Medical knowledge teaching

3.2.2 Health management

Health management includes the function of drug identification that lets the user knows drug name and which patient needs to use that drug. If an emergency situation occurs, the helper can use this function to assist help the patients. Furthermore, this system has the function of a medication reminder that can prevent patients from forgetting to take their medicine. This is shown in Fig. 11.

3.3 Medication reminder

The medication reminder can let the patients set their medication time freely. If the set time has passed, the machine will emit a warning sound to inform the patient that he/she needs to take his/her medicine. This is shown in Fig. 12.

3.4 Drug identification

The drug identification feature can protect patients from taking the wrong drugs. In general, people often do not know which drugs they need when they face a variety of drugs. Using the function of RFID identification to identify the tag of their drugs can assist them in knowing which medication they need to take and when. Having the RFID tag in place will help to ensure that patients take the correct medication at the correct time and prevent them from taking duplicate does or the wrong drugs. When the user employs the machine to measure temperature, blood pressure and pulse, the data will automatically upload to the Radio Frequency website through the hub. The user can employ his cell phone to connect to the RF website in order to determine whether the user has a high fever or high blood pressure. The architectural design is shown in Fig. 13; the RF website is shown in Fig. 14.

4. Conclusions

Currently, health management is one of the most important topics for everyone, because losing one's health risks losing one's life. To respond to the necessity of health management, we have designed a health management system that uses Android and RFID to provide an easy method of physical health management.

Instruction in medical knowledge is incorporated into health education lessons in primary and secondary schools; it combines the RFID identification technology and the Human Body Model. We can understand the body's organs via basic

knowledge of medicine; the health management system is especially suitable for users afflicted with multiple diseases because the system can help them manage the multiple medicines they probably require. A patient's inability to identify a particular medication, or a lack of understanding regarding the role of a particular drug and why he/she needs to take it, may lead to noncompliance, which will render the drug ineffective; likewise a patient's inability to manage a multiple-drug regimen will compromise or void the usefulness of the prescribed medications. The system we propose enhances drug identification for users and also functions to provide a medication reminder, helping to ensure that the user takes hid/her medicine on time.

Our proposed system can be used in training nurses or other non-nursing relevant personnel in a health-care setting or in primary and secondary school health education programs. Increasing medical knowledge is good not only for patients but also for anyone who cares about his/her health. The system is very useful for patients afflicted by chronic diseases. It not only lets the patient understand the origin of the disease but also lets him/her understand how to manage rehabilitation and how to take the right medicine on time. In addition to these advantages, the system can help the user get immediate help when unexpected situations arise. For example, if someone is injured and the person trying to assist him/her does not know what medicine the injured person can take, the helper can check the drug identification feature to find the drug names so that he/she can save the individual's life and also ease the nursing burden on the family. This system which we propose can work in collaboration with the medical units to obtain complete and professional medical information in the future.

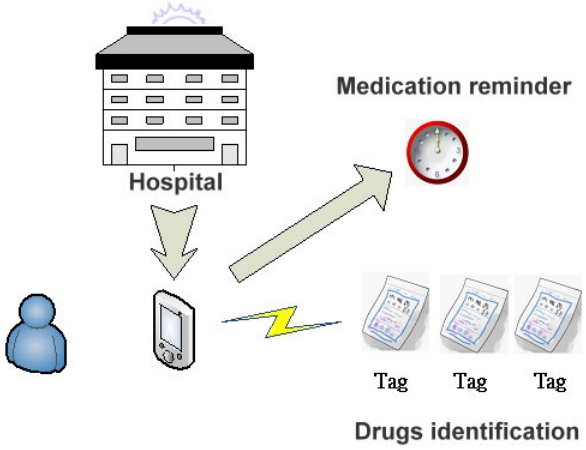

Fig. 11 The architecture of health management

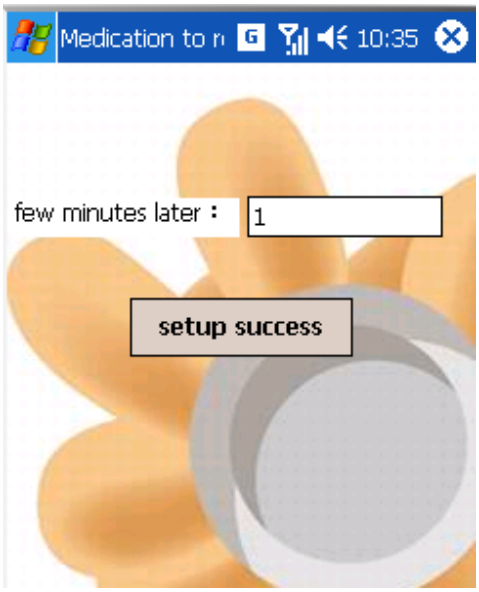

Fig. 12 Medication reminder

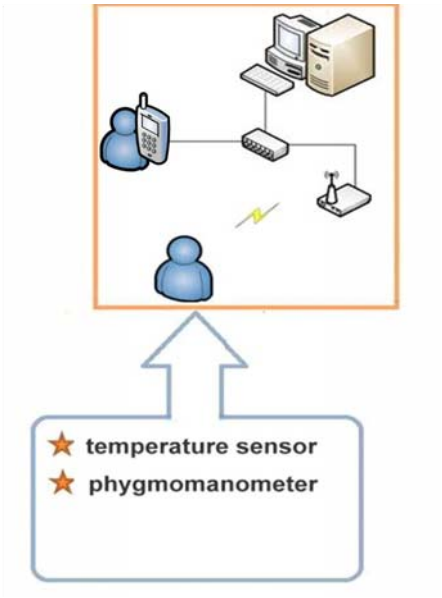

Fig. 13 Architecture of website

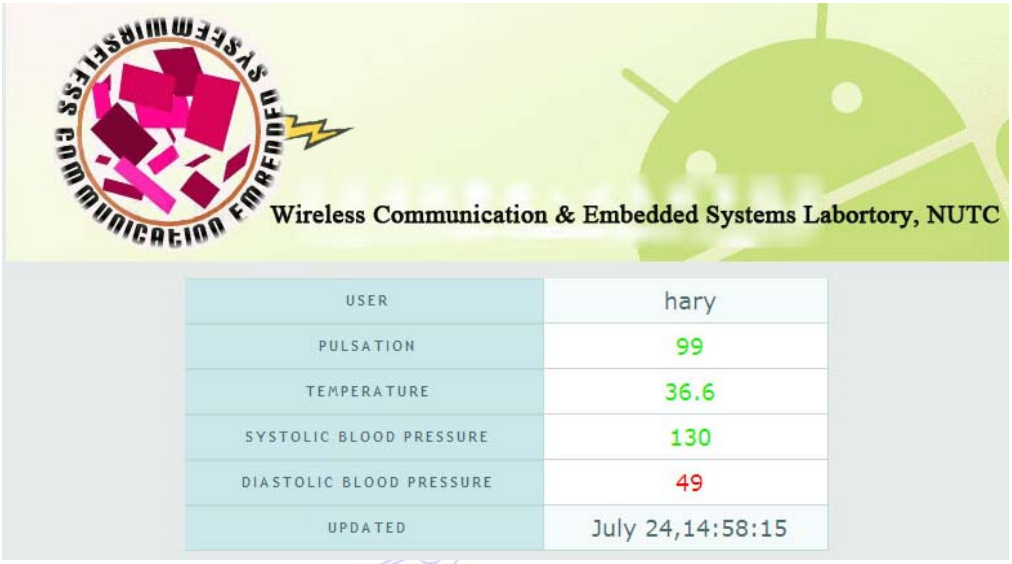

Fig. 14 Radio frequency website

Acknowledgements

This work was supported in part by the National Science Council (NSC) of Republic of China under grant No. NSC 101-2622-E-025-001-CC3.

References

[1] T. F. Chang, C. S. Chen, and H. Zhou, "Smart phone for mobile commerce," Computer Standards & Interfaces, vol. 31, no. 4, pp. 740-747, June 2009.

[2] Y. L. Chen, C. P. Li, J.W. Wang, and J. H. Wen, "Performance analysis of a distributed fixed-step power control algorithm via window concept in cellular mobile systems," In Press Communications in Nonlinear Science and Numerical Simulation, Aug. 2012.

[3] M. C. Chen, J. L. Chen, and T.W. Chang, "Android/OSGi-based vehicular network management system," Computer Communications, vol. 34, no. 2, pp. 169-183, Feb. 2011.

[4] C. Wei and L. Zhao, "Design and implementation of a TD_SCDMA video monitoring system based on Android," Procedia Engineering, vol. 29, pp. 1066-1070, 2012.

[5] R.M. Henderson, "The bigger the healthier: are the limits of BMI risk changing over time," Economics & Human Biology, vol. 3, no. 3, pp. 339-366, Dec. 2005.

[6] C. Fattah, N. Farah, F. O'Toole, S. Barry, S. Bernard, and M.J. Turner, "Body mass index (BMI) in women booking for antenatal care: comparison between selfreported and digital measurements," European Journal of Obstetrics & Gynecology and Reproductive Biology, vol. 144, no. 1, pp. 32-34, May 2009.

[7] N. Attia, N. Fournier, B. Vedie, M. Cambillau, P. Beaune, O. Ziegler, A. Grynberg, J.L. Paul, and B. Guerci, "Impact of android overweight or obesity and insulin resistance on basal and postprandial SR-BI and ABCA1-mediated serum cholesterol efflux capacities," Atherosclerosis, vol. 209, no. 2, pp. 422-429, Apr. 2010.

[8] A. S. Iyer, M. I. Ahmed, G.S. Filippatos, O. J. Ekundayo, I. B. Aban, T. E. Love, N. C. Nanda, G. L. Bakris, G. C. Fonarow, W. S. Aronow, and A. Ahmed, "Uncontrolled hypertension and increased risk for incident heart failure in older adults with hypertension: findings from a propensity-matched prospective population study," Journal of the American Society of Hypertension, vol. 4, no. 1, pp. 22-31, Jan.–Feb. 2010.

[9] E. Grossman and F. H. Messerli, "Drug-induced hypertension: an unappreciated cause of secondary hypertension," The American Journal of Medicine, vol. 125, no. 1, pp. 14-22, Jan. 2012.

[10] L. Cohen, G. C. Curhan, and J. P. Forman, "Influence of age on the association between lifestyle factors and risk of hypertension," Journal of the American Society of Hypertension, vol. 6, no. 4, pp. 284-290, July–Aug. 2012.

[11] M. Tajima, "Strategic value of RFID in supply chain management," Journal of Purchasing and Supply Management, vol. 13, no. 4, pp. 261-273, Dec. 2007.

[12] S. Kim and G. Garrison, "Understanding users' behaviors regarding supply chain technology: determinants impacting the adoption and implementation of RFID technology in South Korea," International Journal of Information Management, vol. 30, no. 5, pp. 388-398, Oct. 2010.

[13] L. A. Stevens, G. Viswanathan, and D. E. Weiner, "Chronic kidney disease and end-stage renal disease in the elderly population: current prevalence," advances in Chronic Kidney Disease, vol. 17, no. 4, pp. 293-301, Jul. 2010.

[14] M. J. Fischer and A. M. O'Hare, "Epidemiology of hypertension in the elderly with chronic kidney disease," advances in chronic kidney disease, vol. 17, no. 4, pp. 329-340, Jul. 2010.

[15] A. Dimitropoulos, J. Tkach, A. Ho, and J. Kennedy, "Greater corticolimbic activation to high-calorie food cues after eating in obese vs. normal-weight adults," Appetite, vol. 58, no. 1, pp. 303-312, Feb. 2012.

[16] G.G. Harrison, "Fostering data quality in food composition databases: applications and implications for public health," Journal of Food Composition and Analysis, vol. 17, no. 3–4, pp. 259-265, Jun.–Aug. 2004.