

A New Paradigm for the Spread Sport Leisure Culture Focusing on the IT-Based Convergence Interactive System

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Abstract To this day, active discussions and attempts were made to develop the IT foundation in order to ensure growth and advancement of the sports related industry and to ensure individual companies' marketability and enhancement. In particular, development of the system in the current super high network in Korea that enables effective linkage and sharing of sports related information, and the system's effective management and operation are certainly important issues. In order for the developed IT infra in Korea to act as a growth driver for the sports industry, it is important to develop structured and user-friendly information network to make an effort to connect these information networks in an integrated

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manner. Development and linkage of effective information network in the sports field are expected to become an important medium for satisfying diverse demands for the sports. This research seeks to propose the network for the private virtual sports information network for the development of large capacity for the sports related information based on the nation's technological capability, for the dispersion of the specialized sports information and for the development of super-fast network.

Keywords Sports leisure culture · IT-based convergence interactive system

1 Introduction

'Wellness' was once defined mainly as a combination of 'wellbeing' and 'fitness,' but recently, it is regarded more widely as a compound word of 'wellbeing' and 'happiness' as people pursue the optimal state in physical, mental, emotional, social, and intellectual areas [1]. This change indicates that the concept of this term has advanced to accommodate human conditions, behaviors, and efforts in pursuit of pleasant and safe space as well as healthy and dynamic activity.

In line with the expanded significance of wellness, social interests in it are expressed with such other terms as convergence, complexation, and being smart. As such, the convergence among various industrial sectors including IT is required [2]. This is true not only in the electronic industry but also in human body studies where various cutting-edge science technologies such as electricity, medicine, and life science are comprehensively utilized in active and diversified approaches [3]. Such changes in the trend of researches on the human body and wellness indicate that convergence between IT and other technologies related to the demand for health is expected to change the quality of life drastically, and it draws attention as a core element for 'mega-trend,' that is, a structural reform of the Korean society [4].

Among IT sectors, IoT, big data, and cloud infrastructure have become a dynamic force that makes realtime data collection easy in response to changes in individuals and environments in daily life. In addition, IT makes it possible to analyze a person's lifestyle or to recognize one's various characteristics and situations and analyze the significance in various aspects.

Lifestyle data is utilized as an essential basis for the analysis of personal diseases as well as social and psychological problems and for prediction of future trends. Recent researches in this regard include wellness predictive care service studies to improve the quality of life systematically by extracting lifestyle patterns such as active quantity, location, stress, and sleep. Such researches indicate the emerging paradigm of wellness in utilization of IT.

With this positive influence, the necessity of researches in combination with IT is emphasized not only in medical science but also in sport leisure culture science. The area of sport leisure culture science is divided mainly to elite sports and sport leisure: In the sector of elite sports, coaches and players are more aware of the necessity of scientification and cutting-edge device development for better athletic

performance and player safety [5]. Accordingly, demands for the development of training manuals and state-of-the-art devices in utilization of IT are increasing.

In the sector of sport leisure as well, unique subcultures are being established: Sport leisure participants (club members) seek various devices and athletic performance of elite players, and competition in renewal of records and device purchasing has become a sport leisure culture in Korea. According to researches on the psychology of sport leisure participants, the yearning among them for the athletic performance of elite players can be interpreted as serious leisure. Serious sport leisure participants seek private lessons for systematic training in pursuit of special technical training, knowledge acquisition, and personal experience. They also analyze games of professionals and apply the results to their own matches [6][7]. Their yearning for devices can be interpreted as recreation specialization. Sport leisure participants who have entered the stage of specialization show preferences for certain devices in the process of advancing into the level of experts [8][9]. Personal renewals of records and device purchasing among sport leisure participants result from their competitive spirit and self-esteem, which positively affects such elements as commitment, leisure motivation, satisfaction with leisure and sports, and so forth. In this case, they would hardly stop such leisure activities or sports in the middle [10]. For such various reasons stated above, demands among sport leisure participants for the new It-based device development continue.

In fact, IT-based researches in the area of sport leisure culture science are being conducted: In recent technology trends related to body exercise analysis for example, special sensors are worn on the body to measure heart rates, respiration, blood pressure, and calorie consumption in connection to a wireless network; and such devices, being commercialized, provide individuals with information of exercise intensity, distance, amount, etc. so that they can enjoy scientific sport leisure activities. These methods, however, do not reflect space, emotions, and personal characteristics, which are of a new wellness paradigm. This study discusses IT elements that can be added to the area of existing sport leisure culture science and their expected effects.

2 Possibility of Additional Application of Body Information

In the area of sport leisure culture science, ‘exercise prescription’ has been recognized as the most important service for physical activity management in addition to exercise itself for disease prevention and health improvement through better athletic performance and healthy life habit management. Exercise prescription means to determine the quality and quantity of proper exercise depending on the individual’s current physical strength and to provide exercise programs that specify the form, intensity, frequency, and period based on the health examination, physical strength examination, and exercise load examination. According to existing researches, however, most forms of exercise prescription focused on exercise intensity setting in reference to heart rates, exercise load examination based on oxygen intake and carbon dioxide emission, etc. Basically, exercise prescription aims to provide one-way

communication programs for exercise in reflection of the physical capability and body abilities, which involves limitations in that it does not consider various desires and physical or psychological conditions of individuals.

Accordingly, this chapter discusses state-of-the-art IT elements through which brainwaves that indicate emotional changes during the exercise, new body signals such as body temperature, and environmental information such as temperature, humidity, and intensity of illumination can be collected and analyzed simultaneously.

2.1 Application of Brainwave Technology

The application of brainwave technology makes it possible to grasp emotional and psychological conditions. Brainwaves are divided to delta wave, theta wave, alpha wave, beta wave, and gamma wave depending on the frequency and voltage. Among these, frequencies measured before, during, and after a physical activity are α wave, SMR wave, Mid- β wave, β wave, and γ wave.

As for emotional and psychological conditions depending on the frequency, α waves indicate relaxation and rest, SMR waves attention, Mid- β waves concentration and activity, β waves tension, excitement, and stress, and γ waves intensive stress such as anxiety and irritation (Table 1). It is expected that measuring and analyzing brainwave frequencies before, during, and after a physical activity in application of brainwave technology will lead to forming a new theory.

Table 1 Emotional and psychological state of the EEG

Bandwidth	Name	Characteristic
0.1-3	Δ wave	Deep sleep; brain abnormality
4-7	θ wave	Sleep
8-12	α wave	Relaxation and rest
12-15	SMR wave	Attention
16-20	Mid- β wave	Concentration and activity
21-30	β wave	Tension, excitement, and stress
30-50	γ wave	Intensive stress such as anxiety and irritation

When this robot is worn, it is activated by instantly detecting the electronic signals of the nerves that come into the muscles, and it is possible to move freely according to the users' will. When this shirt robot is worn, power increases, and thus it is possible to lift up heavy objects easily. Thus, it enables the disabled people with weak physical function to walk or to move the arms to lift up the objects. Moreover, 'Loco Mat (Switzerland)', which is a robot for the pelvic limb

rehabilitation training robot, is effective for recuperating the pelvic limb function (Figure 1). In addition, robot for guiding visually impaired people (NSK Company, JAPAN) can provide voice instructions to the visually impaired people while avoiding obstacles with the sensors attached in the front (Figure 2).

2.2 Application of Body Temperature Technology

A human body is supplied with energy necessary for life sustenance while consuming ATP, and as a result, it generates internal heat in the body [11]. Intense physical activities such as exercise, however, facilitate metabolism, which leads to heat generation within the body and imbalanced emission outside the body. As a result, the body temperature increases [12][13].

A proper degree of increase of body temperature and skeletal muscles may facilitate metabolism in the body and exercise in general [14]. However, exercises as long as 1 hour or as intensive as repeated spurts may result in an excessive rise of core temperature and hyperthermia [15][16].

Hyperthermia that results from a long-term physical activity in a high-temperature environment is likely to cause drastic reduction of exercise performance as well as changes in neurotransmitters in the central nervous system such as serotonin and prolactin. As a result, central nervous fatigue causes the psychological desire to continue the abnormal exercise to disappear [17]. Hence, it is expected that measuring and analyzing body temperature appropriately in physical activity in application of this body temperature technology will lead to forming a new theory.

3 Possibility of Additional Application of Environmental Information

In the field of sports, the term ‘condition’ is used to comprehensively represent most situations in which people feel or sense the body conditions in response to physical, mental, and social phenomena as well as environmental situations such as weather [18]. The brainwaves and conditions of those who participate in physical activity are affected by environmental elements such as temperature, humidity, and intensity of illumination.

Weather conditions are considered as an important variable in evaluating the effect of physical activity mediation researches in the area of sport science. Indeed, such weather conditions as temperature, humidity, and intensity of illumination affect the amount of body activity significantly [19]. Hence, most researches with the quantity of body activity as a variable need to take into account such conditions in the step of research planning [20].

Accordingly, it is expected that measuring and analyzing appropriate environmental information in physical activity such as temperature, humidity, and intensity of illumination will lead to forming a new theory.

4 Example of Application

The following is an illustration of applying the new bio signals and environmental information drawn from this study to the area of sports. Cycling is a type of sports that require scientific training programs consistently in order to improve the athletic performance [21]. Now that the responsibility of the government for various types of bicycle accidents as the number of users is rapidly increasing, The IT-based elements discussed in this study are applied to cycling.

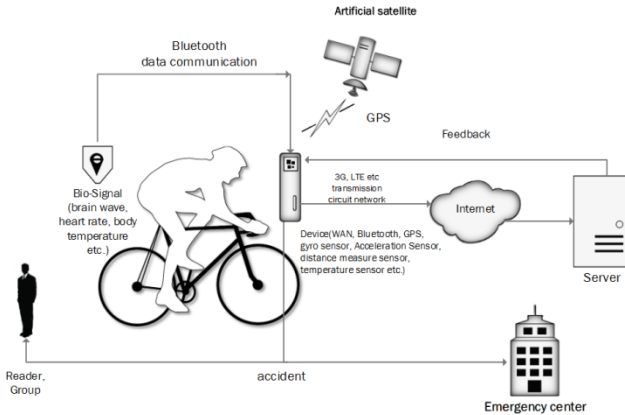


Fig. 1 An Example of Applying IT Elements to Cycling

The device that was mounted on the bicycle included various functions such as 3G, LTE, ISP communication, WAN, Bluetooth communication, GPS, gyro sensor, distance-measuring sensor, brightness sensor, temperature sensor, humidity sensor, etc. A hair-band type or mounting type of brainwave sensors for short-distance communication with the main device and other wearable devices for recognition of bio information such as body temperature and heart rates were also installed. The measurements were processed and stored in a way of the mutual communication with the server via the Internet or VPN with feedbacks sent back to the device. This data can be shared with other groups or companions. Upon emergency situations such as falls or accidents, the data is automatically transferred to an emergency center for immediate treatment. As for judgment of emergency, sudden changes in regular distributions such as speed, heart rates, brainwaves, and gyro sensor are transferred through the device.

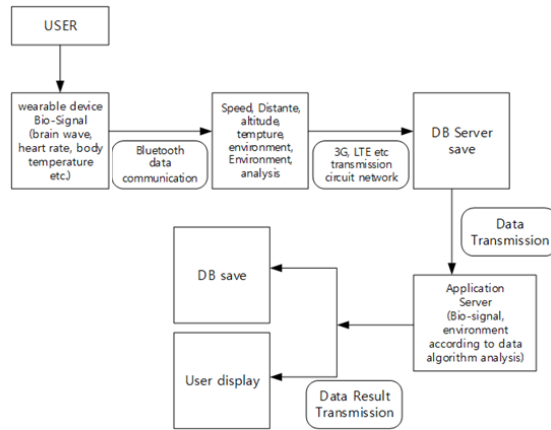


Fig. 2 An Information and Data Processing

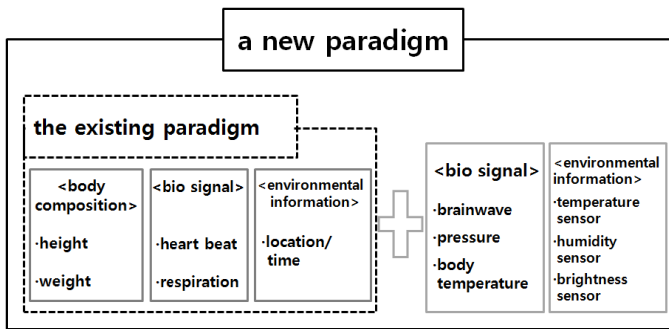


Fig. 3 A new Paradigm for Spread of Sport Leisure Culture

5 Conclusions

In addition to basic data of physical states such as body composition The objective of this study is to discuss IT elements that can be added to the area of sport leisure culture science and to present expected effects. This study points out the necessity of developing new IT-based technology for sport leisure in response to the social and cultural changes, demands in the area of sport leisure culture science, and psychological aspects of sport leisure participants. Accordingly, this study discusses the application of IT elements for simultaneous collection and analysis of various data sets such as environmental information such as temperature, humidity, and intensity of illumination and brainwaves that indicate emotional changes, and body temperature that indicates bio signals n (height, weight, etc.), physical factors, heart rates, respiration, calorie consumption, exercise intensity, exercise distance, and amount of exercise. The application of this technology to devices will contribute to a two-way communication of optimized exercise feedbacks (type, intensity, frequency, and period of exercise) in consideration of the participants’ desires and

physical/psychological states realtime. In addition, it is expected that a new theory that takes into account emotional aspects in the process of exercise can be developed.

References

1. Han, T.-H., Min, K.-P., Son, J.-G.: A case study on device for wellness services. *Weekly Technology Trends of National IT Industry Promotion Agency* **1639**, 14–26 (2014)
2. Park, S.-H., Jang, D.-G.: IT Convergence Trends in Wellness. *Communications of the Korean Institute of Information Scientists and Engineer* **31**(3), 61–72 (2013)
3. Cho, W.-D., Yang, S.-K., Taag, C.-S., Baek, J.-S., Min, M.-G., Lee, Y.-K., Park, K.-C., Lee, K.-P.: A study on IoT-based lifelog Big Data-based lifestyle (lifestyle) analysis and forecasting wellness care service system. *Journal of The Korean Institute of Communication Sciences* **31**(12), 17–24 (2014)
4. Korean Informaion Strategy Development Institute, National Strategies for IT-Based Development of Future Korea 2004 Annual Report (2005)
5. Junge, A., Engebretsen, L., Alonso, J.M., Renstöm, P., Marshall, S.W., Golightly, Y.M.: Sports injury and arthritis. *North Carolina Medical Journal* **68**(6), 430–433 (2007)
6. Hwang, S.-H.: Effects of the levels of participation of skiers in leisure activity on recreation specialization and serious seisure. *Journal of Sport and Leisure Studies* **40**(2), 811–819 (2010)
7. Lee, C.-W., Kim, C.-H., Song, W.-I.: Lived experience of Taekwondo training as serious leisure for female college student. *Journal of Leisure and Recreation Studies* **29**, 261–270 (2005)
8. Kim, M.-K.: The relationships between serious leisure, recreation specialization and leisure addiction. *Journal of Leisure Studies* **13**(1), 89–104 (2015)
9. Lee, M.-J., Hwang, S.-H.: Leisure constraints according to the recreation specialization levels of ski participants. *Journal of Leisure and Recreation Studies* **36**(3), 72–82 (2012)
10. Kim, M.-K., Park, S.-J.: Grounded theoretical analysis on the formation of leisure addiction. *Journal of Leisure and Recreation Studies* **38**(3), 1–16 (2014)
11. Brooks, G.A., Donovan, C.M., White, T.P.: Estimation of anaerobic energy production and efficiency in rats during exercise. *Journal of Applied Physiology* **56**, 520–525 (1984)
12. Gleeson, M.: Physiology of body temperature regulation: temperature regulation during exercise. *International Journal of Sports Medicine* **19**, 96–99 (1998)
13. Web, P.: The physiology of heat regulation. *American Journal of Physiology* **268**, 838–850 (1995)
14. Nybo, L.: Hyperthermia and fatigue. *Journal of Applied Physiology* **104**(3), 871–878 (2007)
15. Drust, B., Rasmussen, P., Mohr, M., Nielsen, B., Nybo, L.: Elevations in core and muscle temperature impairs repeated sprint performance. *Acta Physiologica Scandinavica* **183**(2), 181–190 (2005)

16. Morrison, S., Sleivert, G.G., Cheung, S.S.: Passive hyperthermia reduces voluntary activation and isometric force production. *European Journal of Applied Physiology* **91**, 729–736 (2004)
17. Nybo, L., Secher, N.H.: Cerebral perturbations provoked by prolonged exercise. *Progress in Neurobiology* **72**(4), 223–261 (2004)
18. Hong, J.-H.: An Analysis of the Condition Construct and Development of Sport Condition Inventory in Korea. *The Korean Journal of Physical Education* **42**(3), 259–268 (2003)
19. Bassett, D.R., Schneider, P.L., Huntington, G.E.: Physical Activity in an Old Order Amish Community. *Medicine & Science in Sports & Exercise* **36**(1), 79–85 (2004)
20. Tudor-Locke, C., Ham, S.A., Macera, C.A., Ainsworth, B.E., Kirtland, K.A., Reis, J.P., Kimsey Jr., C.D.: Descriptive epidemiology of pedometer-determined physical activity. *Medicine Science & Sports Exercise* **36**(9), 1567–1573 (2004)
21. Kim, J.-H., Kim, E.-K.: The effects of periodization of strength training on athletic Performance related to cycling speed in elite middle and Long distance cyclists. *The Korean Journal of Physical Education* **48**(1), 375–388 (2009)