Design of Multi-Sensor Based Environment Data Integration Acquisition Module for Realistic Sports Simulation

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1. Introduction

The instrumentation of natural spaces with networked sensors enables long-term data collection at scales or resolutions that are difficult, if not impossible, to obtain otherwise. The intimate connection with their immediate physical environments allows sensor networks to provide localized measurements and detailed information that complement the macroscopic measurements and analysis[1]. Users of experiential content have increased their desires in the participation service, individually differentiated service and the service combining the realistic experience from a simple service[2]. In addition, convergence between industries is accelerated. Changes in desires of users and convergence paradigm between industries are being expanded into the realistic experiential technology development and application services combined with the realistic experience effect to increase the participation motivation and interests of users and maximize the immersiveness and the reality. In addition, studies on multi-sensory experiential application service through collection, exchange, management, processing, storage and device control of complex information of users for a multi-sensory experience of users are in progress. However, mobile integrated environmental information collection device module is necessary for gathering multi-complex environmental information of the real world. In this paper, we would like to propose the module to gather and process the environmental information to apply the environmental information of the real world such as temperature, humidity, illuminance and wind direction to the virtual environment.

2. Related Work

Virtual world enhancing the reality is not necessary to be the same as the reality and it can be provided as a simple environment which can derive a real environment through the 2D graphic or simple manipulation. However, the technology that enables a user to feel a sense of reality and presence in the virtual world that is the ultimate goal of realistic experiential media is thought to realize the alternative reality which is in the technological quickening period. An alternative reality exists only in the imagination through the film, novel and future prediction, but the efforts to realize it appears with recent technological development of the virtual reality. However, the alternative reality in which the reality cannot be distinguished is in the stage of technical gestation and initial experiment yet. So far, only a simple environment is derived from the actual environment and established when the realistic experiential virtual space is built[3]. However, with the development of sensor network technology and manufacture technology of environmental information collection sensors, collection and processing of the environmental information such as temperature, humidity, wind velocity and illuminance of the real world can be available. Wireless sensor networks are being used for a variety of applications such as military surveillance and tracking, environmental monitoring, target tracking and disaster monitoring, patient monitoring and tracking and smart environments. In addition, it is being applied in various areas such as monitoring of changes in the climate and the environment, management and monitoring of growth of agricultural goods and energy production and monitoring by using environmental information collection sensors. Moreover, studies to establish the more realistic virtual space are being conducted by using the environmental information collected from the real world. Targets and scope of connection in the Internet of Things are expected to evolve to Intelligent IoE (Internet of Everything) combined with the virtual world beyond Human, Things and Space from the Things to Things. In this evolution direction, the importance of wearable devices which are always connected to users is emphasized[4].

However, there are some difficulties to individually analyze and use characteristics and APIs of each sensor device when information of the measuring devices using the sensor related to the environmental information is used to establish the realistic experiential virtual space, because interface and APIs are different based on each manufacturer and purpose of use. The mobility and stability are required to collect the environmental information of the outdoor real world in a wide range such as ski, bike and yacht. Thus, we would like to propose the integrated module which collects and uses the environmental information in the real world to establish the realistic experiential virtual space required for the development of a simulator for the realistic experiential sports such as winter sports including ski or ski jumping.

3. Design for the Intergrated Environmental Sensor Module

Environmental factors for the collection of environmental information of the real world for winter sports are given in Table 1.

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[Table 1] Environmental Information factors to be collected

Classification	Environmental information collection requirements
Velocity	Data of velocity fluctuating based on the time are recorded in the analog form
Wind Velocity	Combined with velocity and it is stored at each time zone in the analog form
Vibration	Amplitude is measured at a particular time zone and stored in the analog form
Temperature	Temperature is measured and recorded in each particular section
Illumination	Illuminance is measured based on the weather and the time and it is stored at each time zone

Accuracy of the environmental sensor data to be collected is given in Table 2.

[Table 2] Accuracy of environment sensor data

Classification	Environmental sensor data accuracy
Velocity	GPS-Enabled , Measuring range 0~350km/h
Wind Velocity	Measuring range 2~30m/s (accuracy: ±3%)
Vibration	Frequency: 3~5000Hz, Measuring range 0.02~200mm/s
Temperature	Measuring range : -50~+350℃, accuracy ±1℃
Illumination	Measuring range : 40~40×10^4 Lux, accuracy : ±3%

We would like to have the integrated module for efficient acquisition and storage of the realistic experiential information comprehensively packed with speedometer using GPS, air flow meter, vibrometer, thermometer and illuminance meter to transmit data over the cable of RS232 in the portable PC. It is operated in the portable PC and data are independently stored in DB. Short range wireless communication in the RF way such as Bluetooth and ZigBee and RS232 or RS485 ways in order to transmit data of realistic experiential environment obtained in each measuring device to the portable PC. We compare advantages and disadvantages of wired communication and help them to choose wired or wireless transmission ways through the comparison of delay or loss of transmitted data.

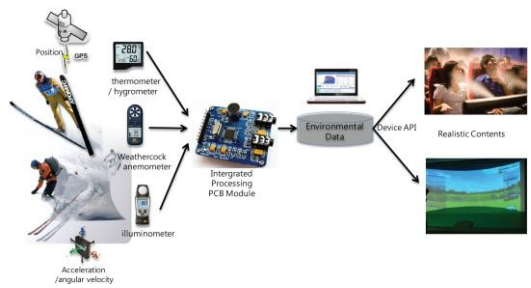

Figure 1. Intergrated Environmental Sensor Module

4. Conclusion

The integrated environmental information collection module proposed in this paper will help a developer (user) reduce the expenses spent for collection and process in a single device by comprehensively providing data of a variety of environmental information collection devices. In addition, it can be utilized in various areas such as environmental pollution requiring the environmental information, agricultural technology, smart home network and energy monitoring including real experiential interaction and experiential virtual simulation. Technology related to real experiential media has been studied and developed focusing on the reproduction of effects such as chair vibration, wind, water vapor, scent and lighting effects. However, it can be utilized as the prototype for collection of real experiential environmental information and the information for reproduction of realistic experience in the future.

5. References

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