

## Development of Context-Aware Real-Sense Services for Multi-Media and Multi-Device Environment

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**Abstract-** In this paper, we propose based real sense media services based on context-aware. Some real sense technologies provide the same services without considering the users' preferences and context. So, some users don't want the unilaterally and passively real sense services. For solving these problems, we consider the users' context, such as gender, age, preferences and provide the adequate real sense services for each user. First, we collect the context of users, environment and devices; then, we process and select the proper services considering the situation. Using this method, we can provide context-aware based real sense services for users more appropriately.

*Keywords-real sense; context-aware; preference; ubiquitous.*

### I. INTRODUCTION

As many 3D contents and services are widely used, real-sense technologies are studied and developed to provide more realistic feeling for users. They focus on the real-sense media playback, multiple audio/video synchronization, sensory effects, and so on [1]. Most of real-sense services provide unilateral and passive effects. But, all users do not like the same real-sense effects, and some services are not adequate for some situations. For example, someone likes water spray effects, but the other does not. Therefore, if we consider context-awareness in real-sense service, then we can provide real-sense effects with considering users' preferences and context. Context-aware computing is the ability of a user's applications to discover and react to changes in the context in which they are situated [2][3]. If we think over these technologies for real-sense services, then users will feel more sympathy by considering contexts, such as users' age, gender, tastes, environmental situation, and so on [4]. So, we propose real-sense media services based on context-awareness for multi-media and multi-device environment. Multi-media means the contents are created and encoded using various media, such as several cameras, real-sense devices, in order to real-sense services for users. The contents are decoded as the original, and processed according to users' context. First, we collect the context of users, environment and devices from sensors and profiles. Additionally, we consider the environment and devices for users; then, we process and provide the proper services for users considering their situation. Using this method, we can

provide context-aware based real sense services more appropriately and effectively.

This paper is organized as follows. In Section 2, we explain the related works of context-awareness and real-sense media services. We describe the context-aware based real-sense media services in Section 3, and present our conclusions in Section 4.

### II. RELATED WORK

As Mark Weiser introduced ubiquitous computing and its vision of people and environments augmented with computational resources, many works for context-aware computing have been studied to provide information and services wherever and whenever users desired [5]. But, it is not easy to recognize contexts about environment and people, and to provide automatic services according to the context without human repulsion [6]. To aware the situation of users and their environment, many technologies are required to collect data, such as sensors, identifiers, predefined context, and so on. These days, there are many researches of context-awareness and applications using it.

The EasyLiving project of Microsoft Research is to develop architecture and technologies for building intelligent environments that contains innumerable devices to provide intelligent environments [7]. Components in the environments include middleware, world modeling, and service description to provide users access to information and services. Also, the devices and systems in the environments have to understand the physical space in order to support richer interactions with users.

The context-aware middleware for ubiquitous robotic companion systems (CAMUS) is a middleware for context-aware applications with a development and execution methodology [8]. The CAMUS provides a context-aware framework for a ubiquitous robotic companion (URC), such as network-based hardware robots or software robots. To do this, CAMUS collects contextual information from various kinds of sensors and transfers the appropriate contextual information to variety of applications. Also, CAMUS provides autonomous service agents to recognize the context and to adapt themselves to different situations. In [9], content recommendation service agent (SA) and context-

aware task were developed based on the service framework and task development methodology of CAMUS.

Internet technologies are also considering context-awareness. As more and more users and services appear and utilize the Internet, it has some technological and operational limits imposed by its architecture in its attempt to give full support to the new requirements introduced by increasing services, applications, and content [10]. Also, users expect higher levels of performance, security, and reliability. Therefore context-aware service discovery is considered in future internet to provide adapted communications for new services, applications and content. This approach is expected to improve the satisfaction of users' expectations by matching offered service characteristics with requirements and preferences previously determined by them.

As we described above, context-aware computing aims for maximizing user's convenience and the utilization of environmental resource. This paper discusses technical issues regarding context-awareness for real-sense media service to consider the users' preference and context information.

### III. CONTEXT-AWARE BASED REAL-SENSE SERVICES

#### A. Conceptual model for the Context-aware based real-sense services

In this paper, we describe a scenario for real-sense services based on context-awareness for the purpose of maximizing the users' comfort and convenience.

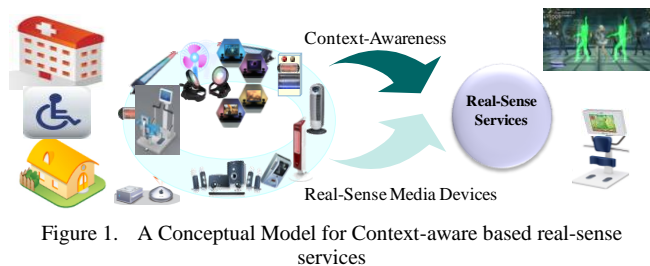


Figure 1. A Conceptual Model for Context-aware based real-sense services

The conceptual model for the Context-aware based real-sense services mentioned above is illustrated in Figure 1. There are many devices for real-sense effect in the home, hospital, education center, and so on. We recognize real-senses in the content, and determine which devices to apply for the service. In this stage, we have some issues on which devices are available and who is the user for the service. To solve the issue, we use some kinds of technologies to recognize the user and devices in the space.

In this paper, we use camera, infrared and 3D depth sensors in the device to detect users and users' motion. For real-sense rehabilitation service, we define some item to describe the users' context and preferences. Using the Real-

sense service based on context-awareness, users feel more comfortable and convenient in the future medical devices.

#### B. Technical Issues

There are some issues to discuss. Figure 2 shows technical issues for real-sense service based on context-awareness. First, sensor platform detects devices in the space or defines configuration information before hand. And we recognize users and environmental information. Temperature, humidity, weather is the environmental information, which is optional and is for further services. In our laboratory, we use devices with various sensors. They can detect the users' physical condition and motion. Secondly, a context-aware framework in a service server recognizes the situation that who is the user, what the service is needed, where the location the service is provided, and which adequate devices the real-sense service play. Then, the context-aware framework notifies this information to the service agent to provide the adequate real-sense service for the user.

Sensor Platform	Context-aware Framework	Service Agent
Device Detection	Location context	Rehabilitation Service
User Detection	User Preference	Therapy Service
Environment Detection	Adequate Devices	Broadcasting Service

Figure 2. Technical issues for Context-Aware based Real-Sense Media Services

#### C. System Architecture

A context-aware framework interfaces with a Sensor platform and an service agent, and arbitrates between them for feeling the physical effects according to the contexts. A sensor platform has sensor nodes, such as camera sensors, infrared sensors, 3D depth sensors, and so on, collect data of the device, environment, and users' situations, and send them to sensor coordinators, which manage several kinds of sensors and interfaces with a context-aware framework. A sensor networking sub-block adds, deletes and updates the information of sensor nodes and sensor coordinators. A sensor interface agent sends and receives messages to and from a context-aware framework in a service server. A context-aware framework consists of a semantic analyzer, a context ensembler, context manager and a context-aware interface agent. After a context-aware interface agent receives sensing data from a sensor platform agent, a semantic analyzer performs analysis of the received data's meaning. Then context ensembler configure and register the context information messages and send them to an service agent. In case of a locational context, a context-aware framework receives raw data related to location from a sensor platform, analyzes its meaning, forms context information message, saves them to a context repository as context schema, and sends them to an service agent. In an

service agent, real-sense services are modeled for users, and customized services are formed as the users' preferences. Then, a service interaction sub-block mediates the operation

of real-sense services as the predefined priority rule, where the rule is provided by users according to the their preference.

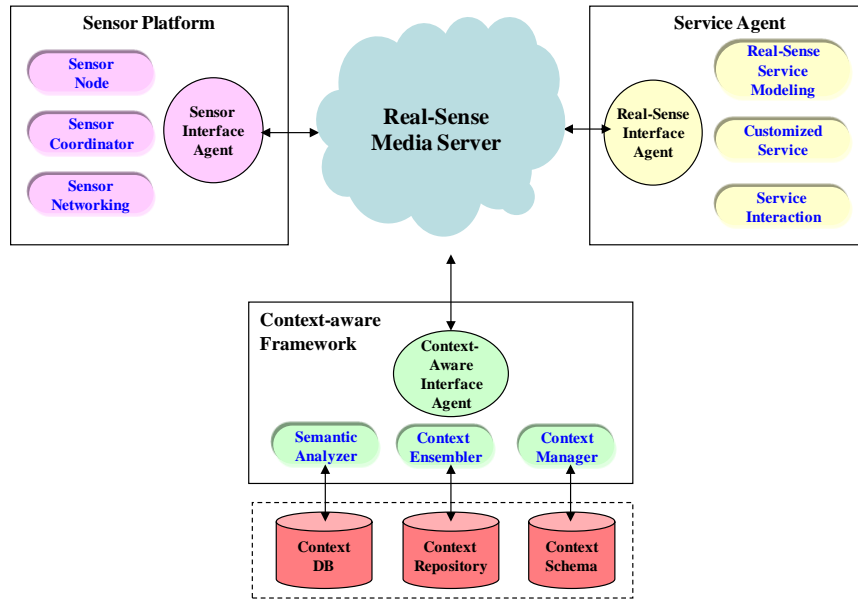


Figure 3. System Architecture for Context-Aware based Real-Sense Media Services

D. Service Flow

The proposed system consists of a sensor platform, a context-aware framework and an service agent, where a context-aware framework and an service agent is in a service server. The sequence flow for real-sense service based on context-awareness is shown in Figure 4. In the service scenario, the user, Harry, wants to play real-sense game. First, context-aware framework recognizes the user and his location using various sensors, such as camera, infrared and 3D depth sensors. Then, the context-aware framework

analyzes and recognizes his context and select the adequate real-sense service using his cotext and profile with preferences. He likes the wind and moving chair effects, and does not want water spray effects in the predefined his preference. Also, his preference can be changed using his actions in the effects. The service agent receives the context from the context-aware framework, and designs real-sense effects for Harry's game service. Finally, the service agent selects and triggers the devices according to the context received from context-aware framework.

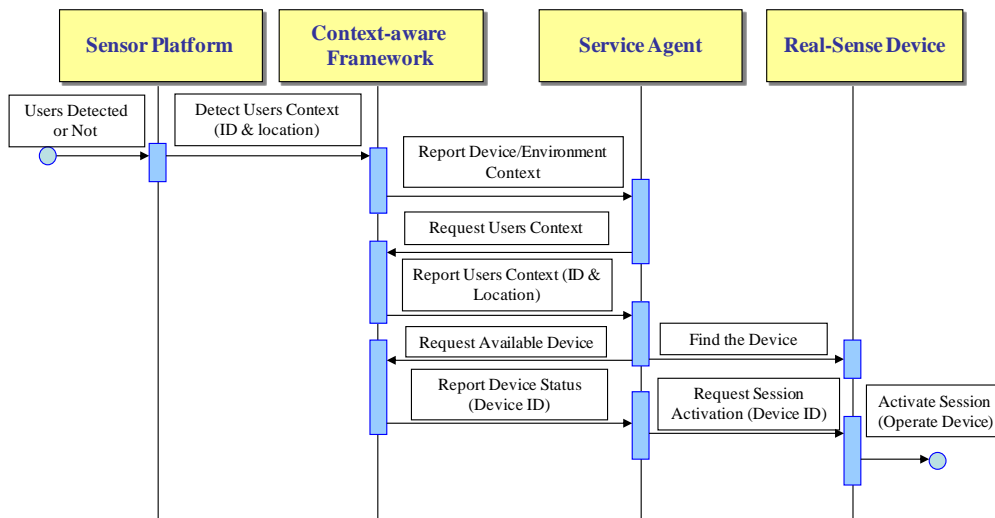


Figure 4. . A Sequence Flow of Context-Aware based Real-Sense Media Services

#### IV. CONCLUSION AND FUTURE WORK

In this paper, we proposed real-sense media services based on context-awareness. First, we collected the context of users, environment and devices from sensors and profiles. Then, we considered the environment and devices for the services and users. We processed context information to provide adequate services for users considering their situation. Using this method, we could provide context-aware based real sense services more appropriately and effectively.

In future work, the authors will focus on the interaction issues among several users in the same space. We will consider various scenarios to present service policy and interaction mechanism for solving the issues.

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#### REFERENCES

- [1] J.K. Yun, J.H. Jang, K.R. Park, and D.W. Han, "Real-Sense Media Representation Technology Using Multiple Devices Synchronization," *Software Technologies for Embedded and Ubiquitous Systems, LNCS 2009*, vol. 5860/2009, 2009, pp. 343-353.
- [2] William Noah Schilit, "A System Architecture for Context-Aware Mobile Computing," PhD dissertation, Columbia University, New York, 1995.
- [3] S. A. N. Shafer, B. Brumitt, and J. Cadiz, "Interaction Issues in Context-Aware Intelligent Environment," *Journal of Human-Computer Interaction*, vol.16, no. 2, 2001, pp.363-378.
- [4] H. Lee, S. Lim, and J. Huh, "Design and Implementation of Intelligent Home Care System based on Context-awareness," 2004 international conference on computers, communications and systems, vol. 1, Daegu University, South Korea, 2004, pp. 169-173.
- [5] M. Weiser, "Some Computer Science Issues in Ubiquitous Computing," *Commun. ACM*, vol. 36, no. 7, July 1993, pp. 75-84.
- [6] W. N. Schilit, "A System Architecture for Context-Aware Mobile Computing," PhD dissertation, Columbia University, New York, 1995.
- [7] B. Brumitt, B. Meyers, J. Krumm, A. Kern, and S. Shafer, "EasyLiving: Technologies for Intelligent Environments," *LNCS 1927*, Springer-Verlag, September 2000, pp 12-29.
- [8] Y. Ha, J. Sohn, Y. Cho, and H. Yoon, "Towards Ubiquitous Robotic Companion: Design and Implementation of Ubiquitous Robotic Service Framework," *ETRI Journal*, vol. 27, no. 6, 2005, pp. 666-676..
- [9] A. Moon, H. Kim, H. Kim, and S. Lee, "Context-Aware Active Services in Ubiquitous Computing Environments," *ETRI Journal*, vol. 29, no. 2, April. 2007, pp. 169-178.
- [10] A. J. Gonzalez, R. M. de Pozuelo, M. German, J. Alcober, and F. Pinyol, "New Framework and Mechanisms of Context-Aware Service Composition in the Future Internet," *ETRI Journal*, vol. 35, no. 1, Feb. 2013, pp. 7-17.