DIY Pervasive Services for Everyday Life

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Abstract. This paper introduces the concept of DIY (do-it-yourself) pervasive services that enable non-experts to establish pervasive computing environments for everyday life. The aim of this concept is that non-expert users can prepare the essential hardware and software for pervasive services, assemble them at appropriate positions, and use them practically. As the first approach, this concept has been implemented in the u-Texture II, which is a self-organizable panel created beforehand as a smart building block. The assembled u-Texture IIs create various pervasive computing environments and each environment provides suitable pervasive services without experts.

1 Introduction

With recent improvements in computer, sensor, and network, pervasive computing technology has spread in the real world, so that pervasive services already support our everyday lives. For example, having only a mobile phone with IC card, users can make a phone call, take a train, make a purchase, unlock a door, and other applications in many locations [1]. Even at home, many people can use high-speed network and have various pervasive services for their private lives. However, most pervasive services are designed and implemented by computer experts. It is difficult for users unfamiliar with computing technology to prepare the essential hardware and software, to assemble them at appropriate positions, and to use and maintain pervasive services. Difficulty in realizing pervasive services without experts is one of blocking factors for applying such services in everyday life. Our goal is to develop technology that enables non-expert users to establish pervasive computing environments by themselves easily. With this technology, everyone would be able to establish such environments anytime anywhere and to obtain various pervasive services.

2 DIY Pervasive Services Concept

This paper proposes the concept of "DIY pervasive services", an architecture allowing non-experts to apply pervasive services in everyday life without experts.

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From our experiments in realizing several pervasive computing systems, we found that such systems should fulfill the following three conditions to enable non-expert users to establish pervasive services by themselves.

Select and Purchase. Enable users to select desired pervasive service in advance and to purchase a set of hardware and software corresponding to the selected service.

Easy Assembly. Enable users to assemble the system, which is the set of hardware and software, easily into everyday life.

Everyday Use. Enable users to use the system in the appropriate location and context of everyday life.

3 u-Texture II: DIY Pervasive Services Framework

As the first approach to implement the DIY pervasive services concept, we have applied the u-Texture II, which is a self-organizable panel created beforehand as a smart building block material. The assembled u-Texture IIs create pervasive computing environments that have shapes such as shelves, tables, and walls and each environment provides various pervasive services. The u-Texture II enables to change its own behavior without user's input through recognition of its location, its inclination, and surrounding environment by assembling them physically. The users can assemble u-Texture IIs easily without knowing the configuration with computers, sensors, and networks inside each u-Texture II.

The u-Texture II is the revised version of the original u-Texture [2][3] to adapt the DIY pervasive services concept. This version is lighter and slimmer compared to the original version. Wired sensor and network are all replaced with wireless devices. The structural prop on the market are used to support the assembled u-Texture IIs because it is possible to put u-Texture IIs in surrounding building materials and appliances with the prop. Regarding software of u-Texture II, we have developed a different software for assembling from that of the original u-Texture. The original software named "Shape Assemble Mode" indicates available applications corresponding the shape of the assembled u-Texture. Users cannot confirm candidates of applications before assembling u-Textures. On the other hand, the new software of u-Texture II named "Application Select Mode" indicates candidate for the final assembled shape by selected application in advance. During assembling u-Texture IIs on the software, users can find how to connect u-Texture IIs dynamically on the display of each u-Texture II.

4 Video Summary

We have developed 13 u-Texture IIs and various applications to confirm the potential of the proposed concept. The u-Texture IIs have been normally placed in

a common room of our laboratory and sometimes used in our houses experimentally. The video shows two scenarios with several applications corresponding to each condition of the proposed concept.

Fig. 1. A user purchases a set of hardware and software by selecting pervasive services in advance, assembles the set at the appropriate position without experts, and uses pervasive services in everyday life.

4.1 Select and Purchase

First of all, a user orders u-Texture IIs and their software on a web site to get a system for pervasive services (Figure 1, left). In this case, the user selects not number of u-Texture IIs and software packages, but pervasive service with the assembled shape. When selecting the desired service, a set of u-Texture IIs and their software to establish the service is listed and their prices are indicated. In a delivered box, several u-Textures, extra frames, and prepaid cards with RFIDs for downloading application software are included.

4.2 Easy Assembly

The user can assemble the set as building block easily without experts (Figure 1, center). Before assembling u-Texture IIs, application software can be downloaded into a u-Texture II through a network with the prepaid cards. Software will be copied to another u-Texture II by connecting these u-Texture IIs. During assembling, on the Application Select Mode, users can find how to connect u-Texture IIs dynamically corresponding to the assembled shape on the display of each u-Texture II.

4.3 Everyday Use at Home

By putting a mobile music player with RFID on the horizontally assembled u-Texture, the playing music data is transferred to the shelf-shaped u-Textures through a wireless network (Figure 1, right). The user can listen to the music continuously at home. With a real object with RFID such as a music CD, a movie DVD, or a book, the user can access to its media data instantly. This data is shown on another u-Texture assembled vertically. Moreover, the music

data can be copied to a mobile music player when the user puts it on the same level as the music CD. The u-Texture can cooperate with mobile devices and network appliances.

4.4 Everyday Use in Office

One promising area of the proposed concept is to be applied in offices because there will be various needs of pervasive services for collaborative works and presentations among users. The user can access to the appliances in a room with an electrical key. The u-Texture II collaborates with the appliances through a network. The other user can downloaded presentation data stored in the user's server with the ID card. After, users can exchange the data among connected u-Texture IIs by drag-and-drop operations. Then, the data is presented on the projector. The user can use u-Texture II for the cooperation with surrounding appliances and the other u-Textures.

5 Conclusion

The DIY pervasive services concept has contributed to establishment of pervasive services for everyday life. The assembled u-Textures IIs establish pervasive computing environments that have shapes of everyday objects such as shelves, tables, and walls that can be built without experts. Such environments are utilized as systems for supporting various activities of users or for cooperative work among multiple users. We are also interested in implementing this concept in other types of frameworks. Users can prepare other framework, assemble them, and create novel pervasive services. We believe the proposed concept will be one of the standard ways for establish pervasive services in everyday life.

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