Exhibit Information Personalized Service Architecture

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Abstract. The previous AR is considered quite static, for virtual information is provided by pattern matching (e.g. markers, features of an object, etc.). Therefore, the system in this paper offers dynamic personalized services in that virtual information is displayed according to spectator's situations and carries out context inference by grouping context information into metadata and by measuring similarity. Hence, we suggest a personalized service system offering effective exhibition information by collecting, analyzing, and managing spectator environment information in exhibitions based on a ubiquitous environment.

Keywords: Context Analysis, Augmented Reality, Personalized Service, Exhibit Information

1 Introduction

The term, 'ubiquitous', originates from a Latin root meaning 'being everywhere at the same time' and has become widely known by Mark Weiser [1]. Recently, combination of various IT technologies has enabled dynamically personalized context-aware services in smart and active environments.

Such a change is being applied to exhibitions as well [2][3]. Exhibitions based on the ubiquitous environment make an attempt to offer exhibition information with various services but the contents are still not sufficient and quite simple, failing to satisfy spectators. Therefore, an interface technology, which can increase satisfaction for the services and express multimedia information in a natural way, is required at this point. This is why AR (augmented reality) is attracting attention, for the technology can realize such an interface by offering intuitive and cooperative information.

AR is being applied to various areas including surgery practice, repair of a complicated machine, product marketing, game service, a war simulation for the military, and so on, as depicted in Figure 1. However, current AR technologies are not sufficient to offer dynamic personalized services, for virtual information is sent in a mechanical manner whenever a specific condition is met. Hence, this paper suggests a personalized service system which can offer various types of dynamic exhibition

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information by combining advanced AR interface technologies with context-aware technologies (which can collect the context information of individual spectators).

2 Suggested AR Exhibit Information Service

2.1 Service Architecture

The architecture of the AR exhibition information service suggested by this paper consists of a web server (so that all data are processed on the web), a context grouping module, a case comparison module, and an AR process module as depicted in Figure 3. Spectators receive services by logging into the web through their smartphones, and virtual information appears according to their context information.

The context grouping module collects context information from physical sensors, virtual sensors, video input, etc., and groups the information into XML metadata file so as to compare previous cases.

The case comparison module compares the grouped metadata files with previous cases in order to measure similarities. The analyzed similarity servers as the basis for augmenting virtual information in the AR process module.

The AR process module selects and augments exhibition information by referring to similarity analysis and patterns of detected markers.

2.2 Context Grouping Module

In general, the context information is divided into spectator profiles, exhibition profiles, and spectator environment information while Table 1 shows elements that belong to each category. The profiles are managed by explicit input of spectators and participants in the exhibition through a webpage or a specific service, and the spectator environment information is collected from physical/virtual sensors of a smartphone.

Table 1. Classification and Type of Context

Classification	Type
Spectator Profile	Spectator ID, Password, Name, Age, Sex, Job, Hobby, Address
Exhibit Center Profile	Exhibit Booth ID, Password, Exhibit Name, Booth Location
Spectator Environment Information	Spectator Location, Time, Weather, Date, Marker Pattern

2.3 Case Comparison Module

In this paper, metadata are created in a set form based on the context information collected from various routes, so as to measure similarities.

The created metadata are a new case, and it is compared with previous cases in order to measure similarities. In this paper, we used k-NN(k-Nearest Neighbors), the most commonly used method to measure similarity. The method searches for k number of past cases which are most similar to the new case. And the following formula is used to calculate similarity, applying weight of context information.

$$Similarity(NI, CI) = \sum_{i=1}^{n} f(NI_i, CI_i) \times W_i \Big/ \sum_{i=1}^{n} W_i \qquad (1)$$

NI: New case
CI: Past case saved in the case database
n: Number of attributes held by a case
NI_i: *i* th attribute of the new case
CI_i: *i* th attribute of the past case
$F(NI_i, CI_i)$: Function measuring the distance between NI_i and CI_i
WI_i: Weight of *i* th attribute

In general, the calculated similarity value falls between 0 and 1 (normalized actual number) while a value closer to 0 means low similarity and a value closer to 1 means high similarity.

2.4 AR Process Module

The AR process module in the suggested system is based on markers, including context grouping and comparison modules.

The processing flow mainly consists of marker detection, context aware, and context inference. Finally, the system provides dynamic services for exhibition information, which can be augmented by marker patterns based on similar cases[4] (determined by the similarity measurement).

3 Conclusion

Exhibitions based on the ubiquitous environment make an attempt to offer exhibition information with various services but the contents are still not sufficient and quite simple. Although AR technologies may be able to express such contents in various ways, virtual information is sent only in a mechanical manner whenever a specific condition is met. Hence, this paper suggests a personalized service system which can offer various types of dynamic exhibition information by grouping spectator/exhibition profiles as well as spectator environment information into metadata and by measuring similarity for context inference.

The system suggested in this paper applies marker-based AR technologies for more accurate recognition rates, but it was observed that the context information was less realistic and the speed of data processing slowed down when the types of context information increased. Therefore, AR technologies other than marker-based technologies should be applied and a method of optimizing similarity measurement should be found in the further study.

Acknowledgments

This work (Grants No.00044953-2) was supported by Business for Cooperative R&D between Industry, Academy, and Research Institute funded Korea Small and Medium Business Administration in 2011.

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