Personalized Knowledge Service Framework for Mobile Learning

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Abstract

As mobile technologies become widespread, teachers and students will be increasingly mobile, using more portable devices and interacting with computationally-enhanced learning environment. In this paper, we proposed a personalized knowledge service framework for mobile learning to adapt knowledge to different learners, leveraging Semantic Web Services in support of context awareness. This includes modeling sources of context information as web services that can be automatically discovered and accessed by knowledge adaptation engine, which assist the mobile learners with different sets of learning tasks. The paper then described the decision algorithm based on the requirements process and described the system implementation.

1. Introduction

As mobile technologies become widespread, teachers and students will be increasingly mobile, using more portable devices and interacting with computationally-enhanced learning environment. There has been a tremendous increase of research and experiments in the use of mobile technologies for learning. The proliferation of numerous mobile learning systems, such as [1], illustrates the importance of developing wireless and mobile learning applications.

In this paper, we proposed a personalized knowledge service framework for mobile learning to adapt knowledge to different learners, such as peter in the above scenario. In the next sections, we will illustrate the framework and our approaches.

2. Personalized Knowledge Service Framework

The Personalized Knowledge Service Framework for mobile learning (PKSF) is used to deliver personalized e-learning service for the mobile learners. The system architecture of PKSF is illustrated in Figure1.

2.1 System Architecture

The adaptive knowledge engine is fed by many models, learning object models, learner models, learning strategy models, terminal models [2], context semantic manager and any other model that is required. The Knowledge Adaptive Engine (KAE) then interprets the models to produce the personalized output.

2.1.1 Context Semantic Manager . Context information can potentially be acquired from a number of possible resources, which typically vary from one user to another and may even vary over time for the same user. In this framework, the sources of context information are wrapped as semantic web services. This means that each source of contextual information is described by a profile that describes its functional properties in relation to one or more ontologies. Since these profiles are semantic annotated and wrapped as a semantic web services, relevant sources of context information can be automatically discovered and accessed by the knowledge adaptation engine.

2.1.2 Context Information. Learning resources are abstractly grouped to form knowledge ontology. Each ontology can be used by the KAE to teach a required concept. Knowledge ontology abstractly describes the learning resources required to teach a concept. They are used to create sharable and understandable concepts which are an abstract and context-based mapping between knowledge ontology and physical learning resources. This idea of semantic annotation allows for a learning object repository to be searched not only on a keyword basis but on a context basis. Knowledge ontologies are the abstract embodiment of knowledge pertaining to the prior use of the learning object to teach a particular concept [3]. Semantic annotation of the learning object could prove very effective in the domain of Adaptive e-learning.

The learning strategy model is the encapsulation of a pedagogical strategy. It is used by the KAE to produce the personalized knowledge for the learner. The process that the KAE selects physical learning resources to populate the personalized knowledge is called the Learning Design (LD). The rules of LD perform an ontologically supported matching between the learning resource metadata and the learner's model. This

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matching process selects the appropriate learning resources to be delivered to the learner.

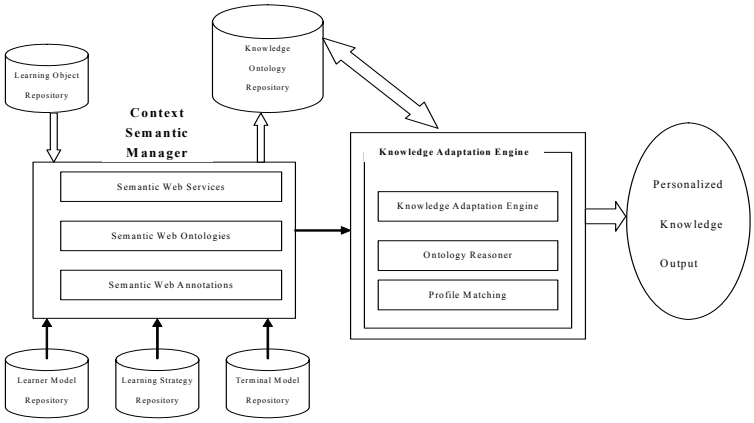

Figure 1: System architecture of PKSF for mobile learning

2.2 Service Process

In general, contextual information about a given user is obtained by sending a query to knowledge adaptation engine. The KAE then relies on a combination of local service identification rules and local and global service discovery mechanisms to identify one or more relevant sources of context information.

The user could be looking for the knowledge: learning resource using a popular ontology called learning resource. Let us assume that OWL-S is used to represent the service as an atomic service with lr:subject as the input and knowledge: computer as the output. Also, assume that the learning resource ontology categorizes computer as a subclassOf of learning resource.

3. Decision Algorithm

In this section, we introduce the application's adaptation decision algorithm, which is used to for profile matching.

```
DecisionAlgorithm (TruthValue
isp1SubsumedByp2,
TruthValue isp2SubsumedByp1,
TruthValue
isIntersectionSatisfiablep1p2) {
if (isp1SubsumedByp2 = "true") {
if (isp2SubsumedByp1 = "true")
return "Exact"
if (isp2SubsumedByp1 = "false")
return "Subsume"
}
else if (isp2SubsumedByp1 =
"true")) return "PlugIn"
else if
(isIntersectionSatisfiablep1p2 =
"true") return "Intersection"
else fail
}
```

Figure 2: A Part of Decision Algorithm

As the code in figure 2 shows, the parameters for the decision algorithm are the reasoner's answers to the subsume and intersection questions of two given profiles p1 and p2, whereas the returned value is the match degree for p1.

4. System Implementation

Based on the proposed framework, we use J2EE technology to implement a personalized knowledge service system for mobile learning. This system can provide adapted learning resources such as web-based courseware to various learner devices. The system consists of four layers: Presentation Layers, Web Service Layer, Business Logic Layer, and Database Layer. The presentation layer includes some components like JSP pages or servlets. In business logic layer, several Enterprise JavaBeans including session EJBs and Entity EJBs are developed. The Session Beans implement function modules such as context description manager and adaptation engine, they also act as Web Services accomplished by RPC-SOAP servlets in the Web Services Layer.

5. Conclusion

The paper introduced novel research into the application of knowledge adaptation to support pedagogically-based mobile Learning. It detailed the requirements and specifications process which led to the development of the Personalized Knowledge Service Framework for mobile learning.

6. References

[1]Yuan-Kai Wang, "Context Awareness and Adaptation in Mobile Learning," IEEE Int. Workshop Wireless and Mobile Technologies in Education (WMTE2004), pp. 8-14, 2004.

[2]Khushraj, D., Lassila, Ontological Approach to Generating Personalized User Interfaces for Web Services, 4th International Semantic Web Conference, 2005.

[3]Payne, T., Lassila, O.: Semantic Web Services (guest editors' introduction). IEEE Intelligent Systems 19 (2004) 14–15.