COMET: Context Ontology for Mobile Education Technology

Sohaib Ahmed and David Parsons

Institute of Information & Mathematical Sciences, Massey University,
Auckland, New Zealand
{s.ahmed,d.p.parsons}@massey.ac.nz

Abstract. The use of mobile devices is increasingly prevalent in education. These devices provide the convenience of supporting access to learning anytime, anywhere. Further, mobile learning provides opportunities to tailor the learning experience to dynamically changing contexts. Major challenges for constructing context-aware models to support this kind of learning include defining the contextual information and adapting to dynamic changes. Ontology-based context models exhibit features such as expressiveness, extensibility, ease of sharing, and logic reasoning support, thus show promise in this area. In this paper, we propose COMET (Context Ontology for Mobile Education Technology) in order to provide a semantically rich model for mobile learning. More specifically, we have demonstrated an example application to show how we can retrieve contextual data from different participating entities within the ontology by using their semantic understanding.

Keywords: Mobile learning, Context, Ontologies.

1 Classifying Context Information

Context can be viewed from different perspectives but there is no definite agreement about what should be modeled in the area of context. Most previous work on context in mobile computing focuses on a common core that includes environment and human dimensions [1]. Kurti et al. [2] suggested a conceptual framework in which activity is one of the three dimensions of context including environment and personal dimensions. Our approach to context modeling builds on their work.

The development of context-aware applications deals with a number of technological challenges and requires the existence of a suitable context model that can be represented and understood between different entities like devices and applications. Some other context-aware systems have been developed in terms of device adaptability including tourist applications [3] and Innsbruck. Mobile [4]. In both applications, adaptation is used in a single direction, from resource to device, as contents are adapted according to different device types. However, such uni-directional transformations do not fully explore the application of context-aware systems that adapt from multiple perspectives. For comprehensive adaptivity support, we need an approach which can deliver adaptive contents from any platform, in any format, to any device, through any network, at anytime, anywhere [5].

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In recent years, ontologies have emerged as one of the most popular and widely accepted tools for modeling contextual information in mobile computing domains [6]. Several context ontologies have been proposed but thus far they have not been able to capture all the relevant information needed for technology enhanced mobile education. We have developed the COMET context ontology based on three key concepts [2]. The purpose of defining such ontology is to demonstrate how different entities can be inter-related and used in order to extract specific information in a mobile learning environment.

2 Usage Scenario

As a proof of concept, we consider two key scenarios; one in which an educator wishes to identify suitable mobile applications for their students according to the availability of specific mobile devices, and another in which she wishes to identify devices that can run a chosen application. We have taken 11 recent mobile applications and around 60 mobile devices and their supported versions with some other related information to show how they are semantically inter-connected (fig. 1). To test the utility of our ontology we built a prototype ontology-driven web application that demonstrates information retrieval using SPARQL queries from multiple perspectives.

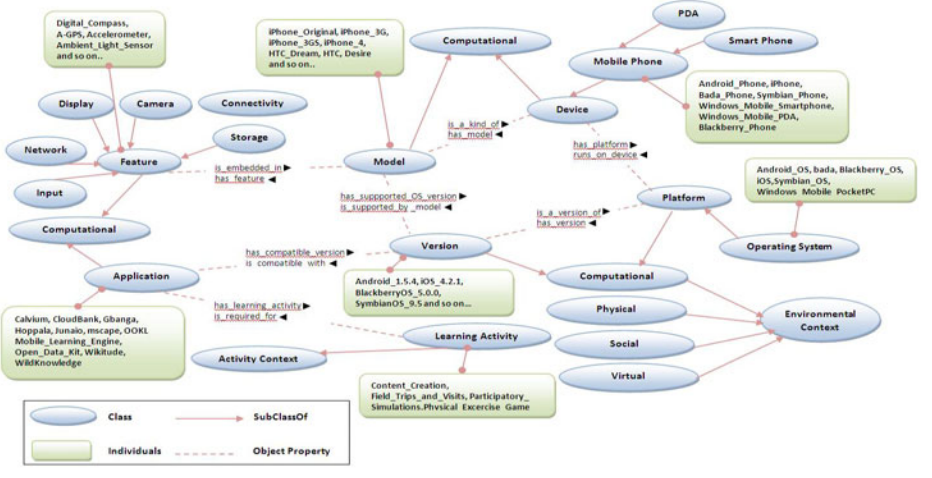

Fig. 1. Excerpt from COMET

For instance, if we want to extract information such as a list of mobile devices which can support a particular application (e.g. Hoppala) or list of applications which can run on a particular mobile model (e.g. Android Phone) to support a given learning activity (e.g. Field Trips and Visits), these defined relationships between entities can help us to extract the relevant information from multiple complementary perspectives (e.g. fig. 2).

Query Result

Application	Website Address	Description
Hoppala	http://www.hoppala-agency.com	Hoppala Augmentation provides an easy way for non-technical creatives to start experimenting with augmented reality platform, Layar. It simply runs in the browser, there is no software installation required and no coding needed at all.
WikiTude	http://www.wikitude.org/en/	WikiTude is a mobile application that provides an Augmented Reality(AR) platform. Wikitude World Browser application displays information about users' surroundings in a mobile camera view.
WildKnowledge	http://www.wildknowledge.co.uk	WildKnowledge(WK) allows users to create & share interactive forms, keys, maps or images for use on PCs,laptops or mobile devices.

Fig. 2. Partial query result from one perspective of the ontology

3 Conclusion and Future Work

In this paper, we have discussed the need for an underlying context model for mobile education technology which we provide in the form of COMET. The work presented here is still in early stages. We are currently working on the design of context and domain ontologies. In future, we may leverage these ontologies to develop an adaptive learning environment. Further, adaptation of the learning contents may be explored by using more real life scenarios. That might help us to understand how ontology-driven applications can possess the necessary flexibility to support mobile learner activities in varying contexts.

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