

Ontology-Driven E-Learning System for Automated Personalized Learning Service

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Abstract: Ontology has gained popularity in building knowledge base because the description, localization and effective reuse of software patterns and systems of patterns can be approached through an ontology-based formalism. This paper designs ontology in the mobile phone domain for the construction of knowledge base, and presents a new method for knowledge assessment in which quizzing questions are drawn using the mobile phone ontology-based knowledge base to assess the level of professional knowledge of mobile phone salespersons.

Keywords: Ontology, knowledge base, knowledge assessment, e-learning

1. Introduction

Today is the age of wireless communication which gives rise to mobile phones [1]. With the rapid development of mobile phones, consumers have to deal with an immense amount of information when selecting the most suitable mobile phone to meet their needs. On the other hand, mobile phone salespersons have to learn all the knowledge in regards to the mobile phones they are selling in order to respond to consumer queries. Hence, the level of professional knowledge possessed by mobile phone salespersons is critical.

Ontology has had its applications in knowledge representation and modeling, especially in the area of e-learning. There are research works and solutions related to ontology usage for modeling of personalization in an e-learning environment [2].

This paper designs ontology in the mobile phone domain for the construction of knowledge base, and provides a knowledge assessment scheme in the form of an ontology-based quizzing module to measure the level of professional knowledge possessed by mobile phone salespersons. Finally, an automated learning service is provided to offer users personalized learning contents subject to their knowledge deficiencies.

The rest of the paper is organized as follows. Section 2 describes the mobile phone ontology for the construction of the knowledge base. Section 3 presents an automated learning service to treat user knowledge deviations via personalized learning contents. Finally, Section 4 gives a general conclusion.

2. Mobile Phone Ontology

Ontologies are knowledge representation structures particularly useful for the specification of high-level reusable software abstractions. They provide an unambiguous terminology that can be shared and reused by all involved in a development process [3].

For the purpose of our research, mobile phone ontology is divided into two parts:

components and style of mobile phone. The components of a mobile phone are further broken down into three groups: hardware, software and pattern. Note that, for example, the software group can be divided into operating system, operation support, protocol, application and so on. Mobile phone style refers to the exterior description, such as shape, color and so on.

Here we present the main terminologies of the ontologies associated with mobile phone components. The concepts of mobile phone will be divided into seven parts, namely, model, hardware, software, standard, brand, shape and color. Figure 1 shows a simple hierarchical graph of mobile phone ontology concepts.

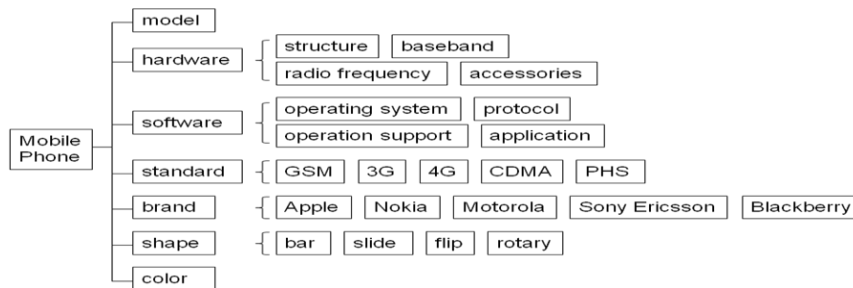


Figure 1 Hierarchical graph of mobile phone ontology concepts.

The top-down approach is adopted in defining classes under each concept, and sub-classes are continued to be added until further expansion is not possible. For example, the shape of a mobile phone is divided into four sub-classes which are bar, slide, flip and rotary.

Attributes are formed to establish relationships among concepts. Six attributes are formed as shown in Figure 2. “Has brand” implies a relationship between phone and brand, “has shape” implies a relationship between phone and shape, and so on.

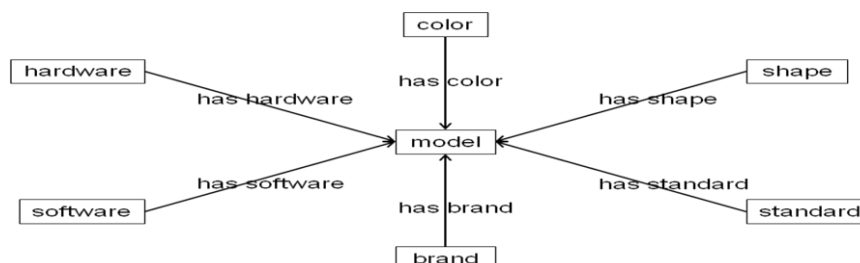


Figure 2 Relationships among mobile phone ontology concepts.

3. Automated Mobile Phone Knowledge Learning Service

Here we devise an automated learning service that incorporates a knowledge assessment scheme in which an interactive quizzing module can draw questions, using the mobile phone ontology-based knowledge base. Specifically, the interactive quizzing module generates quizzing questions using the concepts and instances in the mobile phone ontology-based knowledge base and records quiz performance to create “User Knowledge” profile as shown in Figure 3. The blue nodes in the knowledge tree represent concepts a user is familiar with, whereas the red nodes represent concepts a user has little or no knowledge of. Furthermore, to prevent a user from memorizing quiz answers, the structure of the quizzing questions is designed in such a way that the inference engine in the automated learning service can detect conceptual mistakes made by a user and infer areas of insufficient knowledge as “User Missing Knowledge”. Finally, the automated learning

service provides personalized tuition with learning content tailored for individual users according to their knowledge deficiencies.

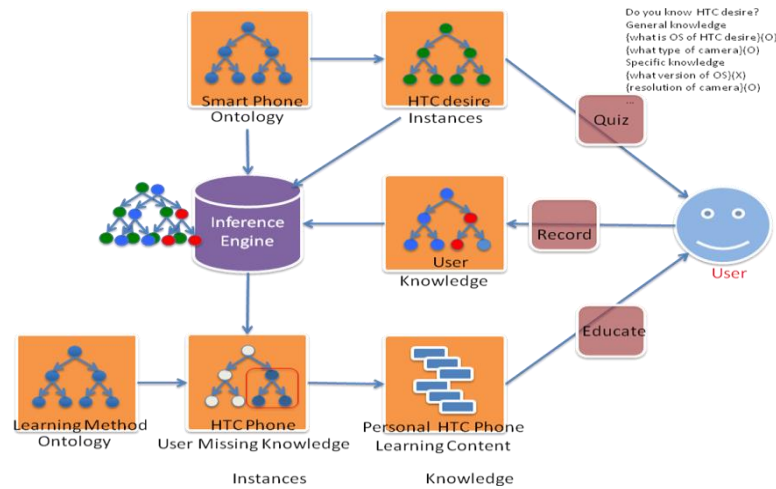


Figure 3 Automated learning service.

For example, HTC phones are on promotion at a mobile phone shop, and the quizzing module would generate questions of increasing difficulty to evaluate knowledge capabilities of salespersons. Note that entry level concept such as (e.g. {what is OS of HTC desire} is tested before more advanced concept such as ({what version of OS} is examined. If a salesperson knows the version of OS is Android but does not know the difference between versions, and understands all standards of mobile phones (i.e. GSM, 3G, CDMA and PHS) except 4G, the automated learning service would offer learning contents related to operating system and 4G standard as personalized tuition specifically tailored for the salesperson.

4. Conclusion and Future Work

The ontology designed in our research aims at providing a conceptualized description of the mobile phone domain for the construction of knowledge base. The knowledge assessment scheme assesses individual knowledge capability via ontology-based quizzing module and provides personal tuition tailored for mobile phone salespersons subject to their knowledge deficiencies as an automated mobile phone knowledge learning service.

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