Chapter 68
Semantic Approach to Opening Museum Collections of Everyday Life History for Services in Internet of Things Environments

Oksana B. Petrina
Petrozavodsk State University, Russia

Dmitry G. Korzun
Petrozavodsk State University, Russia

Valentina V. Volokhova
Petrozavodsk State University, Russia

Svetlana E. Yalovitsyna
Institute of Linguistics, Literature and History, KarRC RAS, Russia

Aleksey G. Varfolomeyev
Petrozavodsk State University, Russia

ABSTRACT

Technologies of the Internet of Things (IoT) and of smart spaces support creating smart museums based on digitized infrastructures and information systems already deployed in modern museums. Cultural heritage knowledge in such a museum is used by interested visitors as well as by personnel. This work continues the authors' research on the smart museum concept and its case study of everyday life history in the History Museum of Petrozavodsk State University (PetrSU). The authors develop an ontological model for the needs of studying the everyday life history. The ontology supports integrating descriptions of collected exhibits into a semantic network, where the links reflect meaningful relations between exhibits and other historical objects. They apply the wiki technology within the smart spaces-based architecture of a smart museum. The wiki implements an ontology-enabled system that experts use to extract and represent knowledge hidden in the museum collection. The authors discuss possible semantic algorithms for data mining in the museum semantic network.

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INTRODUCTION

Technologies of the Internet of Things (IoT) and of smart spaces provide an effective base for creating smart museums based on digitized infrastructures and in- formation systems already deployed in many modern museums. In particular, the IoT technologies can be used for the following application problems, which appear in museum-based studies of everyday life history (Korzun, Varfolomeyev, Yalovitsyna, & Volokhova, 2016).

1. Extension of the museum collection on everyday life history by adding semantic annotations about the exhibits by both museum personnel and visitors;
2. Discovery of historic-valued relations (semantics) between collected descriptions and facts about collected exhibits;
3. Construction of personalized recommendations for museum visitors based on the visitor profiles and other context information.

Importantly that solutions to these problems benefit from using various IoT devices available in the museum exhibition room: personal mobile devices (e.g., smartphones or tablets) to access and control information by users, multimedia equipment (e.g., screens and projectors) to show digital information in the room, embedded devices associated with exhibits (e.g., sensors and small displays) to make augmented reality, local servers (e.g., desktop or virtual machines) to store and process emerging information, and communication equipment (e.g., Wi-Fi routers) to provide access to external Internet services.

This paper continues our previous work (Petrina et al., 2017) on semantic network design for a smart museum of everyday life history. We consider the smart spaces-based architecture of a smart museum (Marchenkov, Vdovenko, Petrina, & Korzun, 2016). Our testbed is the History Museum of Petrozavodsk State University (PetrSU). The studied class of information services operate with descriptions of museum exhibits and available information about other historical objects (persons, documents, events, etc.) as we already defined in (Varfolomeyev, Korzun, Ivanovs, Soms, & Petrina, 2015). These services assist collective semantic annotation, information linking, personalized access to the museum collection. Personnel and visitors of the museum can add descriptions, new facts and links to historical facts and other exhibits. The services support enrichment of the museum collection with additional semantics about everyday life history. On the one hand, such services create a smart space where personnel and visitors can effectively operate and collaborate. On the other hand, the Big Data challenge appears since the amount of information grows rapidly with inclusion into the collection the multitude of semantic relations between the collected objects and facts.

Based on the smart spaces-based architecture of a smart museum we propose the following components of the smart museum environment:

1. Ontological model for structural description of collected objects of the everyday life history and their various history-valued relations;
2. The wiki technology to transform the semantics from the existed museum information system to the semantic network using experts and the ontological model;
3. Semantic algorithms for data mining in the semantic network to take into account existing relations between collected exhibits and other historical objects.