Demo: Smart Services for the History Museum of Petrozavodsk State University

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***Abstract*—Smart museum of everyday life history within the History Museum of Petrozavodsk State University is a smart space-based system implemented using the Smart-M3 platform. This demo presents the smart services for the History Museum of Petrozavodsk State University: Visit service, Exhibition service, and Enrichment service. These smart services realize the semantic layer in the smart museum environment as a multi-agent service-oriented information system deployed on the top of museum information systems. Museum personnel and visitors can directly access the multi-agent system and consume services using Personnel client and Visitor client.**

This demo presents the following smart services for the History Museum of Petrozavodsk State University: Visit service, Exhibition service, and Enrichment service [1]. These smart services realize the semantic layer in the smart museum environment as a multi-agent service-oriented information system deployed on the top of museum information systems (MIS) [2]. Museum personnel and visitors can directly access the multi-agent system and consume services using specialized clients: Personnel client (see Fig. 1) and Visitor client (see Fig. 2), respectively.

Exhibition service: The service shows selected descriptions and visual information about the studied exhibits on exhibition touch screens or even on personal mobile devices of the visitors. In fact, the service creates a kind of virtualization when a physical exhibition is augmented with digital representation. As in Visit service, Exhibition service acts as a recommender since the screens show the recommended (most interesting) facts derived from the available knowledge for the current context and situation. Screenshots from a mobile device is shown in Fig. 3.

Visit service: The service constructs a personalized exposition of recommended exhibits for a visitor to study. Such a recommendation is a small set of selected objects from the museum collection. This set is constructed from the available knowledge such that the set represents the most interesting facts for the visitor in her/his current situation. The service is responsible for construction of a visit program that can be personally recommended to a museum visitor. The service is also responsible for program adaptation during the visit depending on the preferences of the visitor and on the dynamically changing situation. The program is visualized on the public screen in the museum environment or on personal mobile devices of the users. Visit service operates with exhibit ranking: a non-negative rank value is associated with each exhibit to describe the recommendation degree (the higher rank the more recommendable). Screenshots from a mobile device is shown in Fig. 4.

Enrichment service: The service supports modification (evolution) of the semantic network by museum personnel and visitors. In fact, a museum visitor can enrich descriptions of studied exhibits, e.g., in the form of adding annotations.

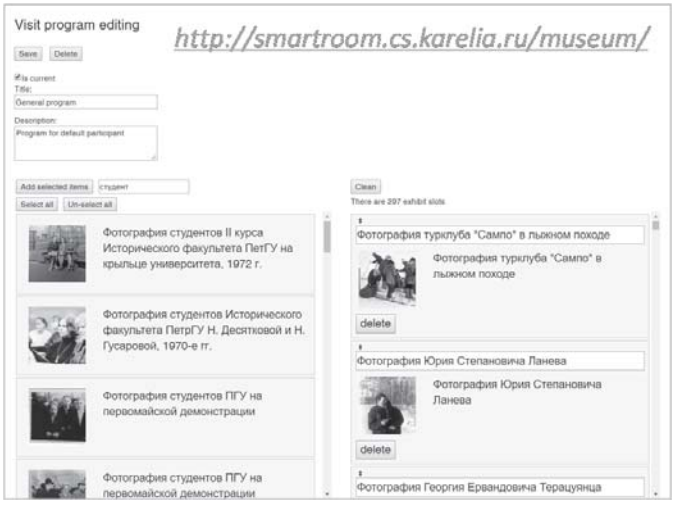


Fig. 1. Screenshot from Personnel client

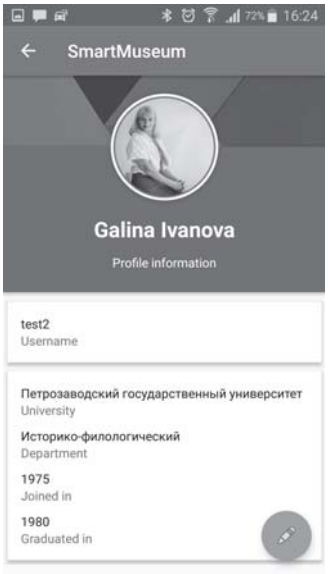
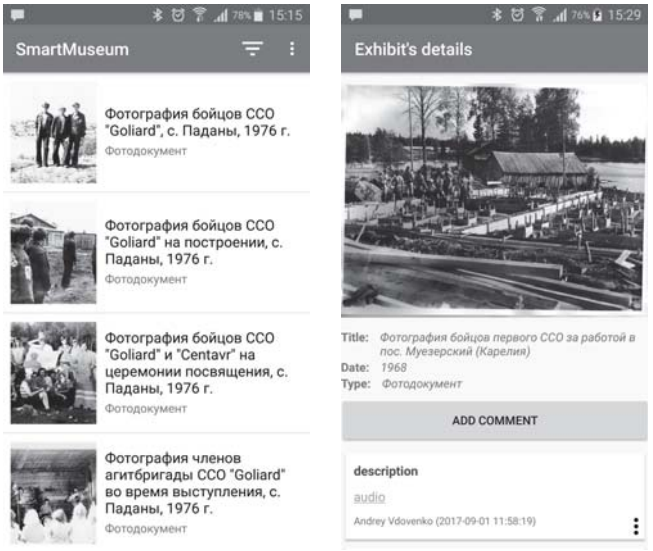
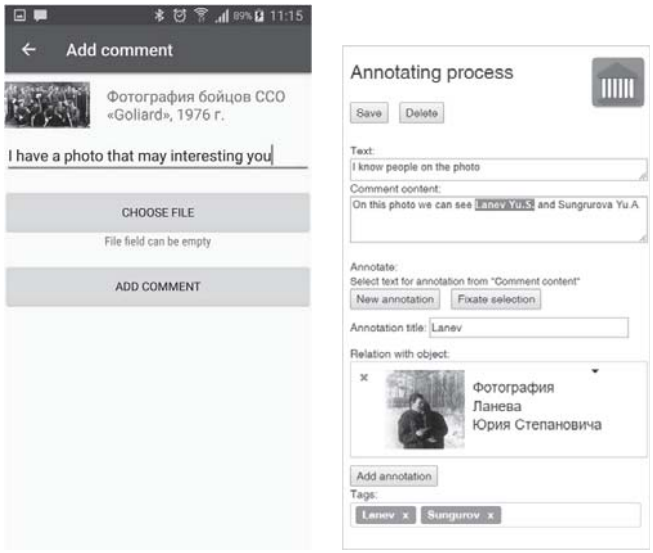


Fig. 2. Screenshot from user profile in Visitor client



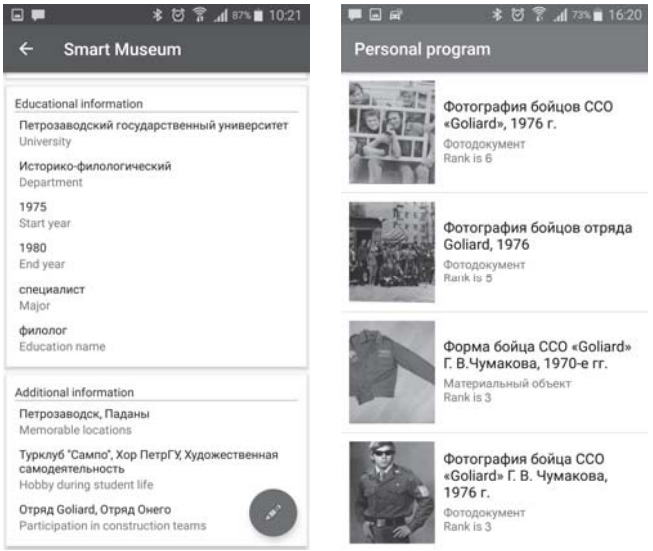
Visit program Exhibit details

Fig. 3. Digital representation of a physical exhibition



Visitor adds comment Personnel annotation

Fig. 5. Collective annotation



Profile details Personal program

Fig. 4. Personal program for a particular user profile

In the smart museum environment, a personal mobile device (e.g., smartphone running the mobile visitor client) becomes a primary access tool for this service. Adding annotations is useful in several scenarios. Firstly, the visitor adds missing descriptions and facts about an object. Secondly, if the visitor knows a history-valued relation of objects then she/he adds the relation (together with its description). Museum personnel can verify the correctness and value of this new information. Screenshots from a Visitor client and Personnel client are shown in Fig. 5.

The semantic layer operates in a shared information space, which implements a knowledge base using the Semantic Web technologies. Shared information follows an ontology and is represented using Resource Description Framework (RDF). The information is stored in an RDF triplestore, which supports information search and processing extensions. Software infrastructure consists of the semantic information broker (SIB) and knowledge processors (KPs) in accordance with the M3 architecture and Smart-M3 platform [3]. SIB maintains the RDF-based knowledge base on top of MIS and other information sources. In particular, this knowledge base keeps the semantic network of museum exhibits and related information. Each smart space service [4] is considered as knowledge reasoning over the shared information corpus and delivering the result to the users and using the multi-agent approach. KPs are software agents that are responsible for service construction and delivery.

Smart service is a result of interaction of several KPs, which reactively or proactively cooperate over the shared information. Visit service is implemented by interacting the following KPs: Visit program KP, Recommender KP, and Visit maintenance KP. Exhibition service is implemented by interacting the following KPs: set of Exhibition-n KPs and Exhibition coordinator KP. Enrichment service, in turn, is implemented by interacting the following KPs: External search KP and MIS interface KP. The system design model for agent-based programming of museum information services is shown in Fig. 6 from [5].

Personnel client and Visitor client are separate client KPs that run on personal mobile devices. The clients provide access and control tool for the semantic network and for service construction. Visitor client supports watching the list of exhibits with their description, to record audio (video) with the comment to the exhibit, and to add text comment. Personnel client supports choosing exhibits for the exposition, adding new exhibits, and moderating reviews and other information coming from the visitors. In addition, personnel can control the current visualization on surrounding screens. Museum personnel and visitors can receive information and operate with services in any time and in other places, in addition to the smart museum environment, due to ubiquitous accessibility of the smart museum. A service is delivered to other services or

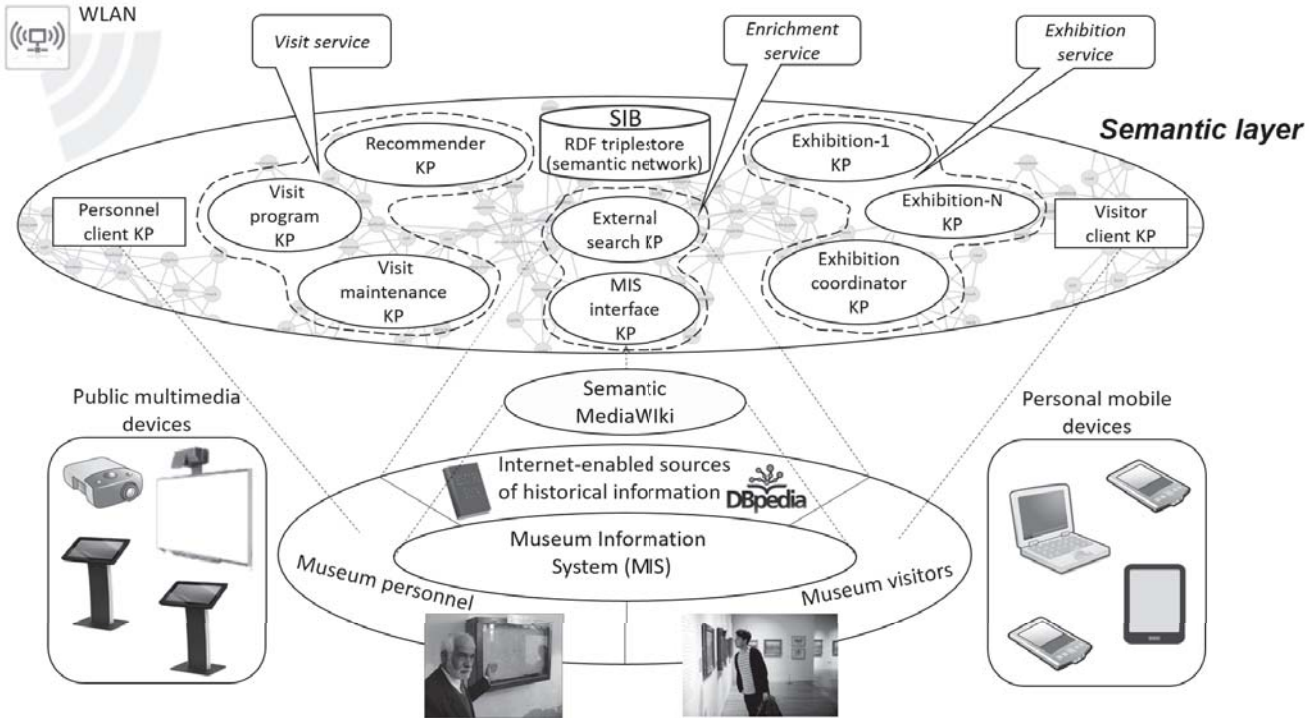


Fig. 6. Semantic layer-based smart museum environment

users (via their client KPs).

Museum visitors use Visitor client for Personal program construction and addition of annotation to exhibit. Visitors use mobile client to add information to specified exhibit. This information added as comments with attachment. On post event client forms HTTP request from comment, that sent to a content service. Content service receives request, determines type of uploaded file, stores it, and posts comment information in smart space and connects it with creator person and related exhibit through appropriate properties. Such comments are assigned with status of moderation.

Personnel take role of moderator and translator of user comments to new exhibits on Semantic MediaWiki. Personnel receive notification on new comments in system through personnel client represented by web application. Personnel check semantic annotation of comment, its appropriateness to specified exhibit and also can add extra tags. After that comment is marked with accept status, other users can see it on the mobile clients. They also can add comments to it with pointing on some conflicts in facts, that can help to personnel resolve controversial situations.

Thus, this demo presented the progress in the development of a smart museum of everyday life history within the History Museum of Petrozavodsk State University. We implemented three smart museum services: Visit service, Exhibition service, and Enrichment service using Semantic Web, Internet of Things, and smart spaces technologies. Our pilot implementation provide the follow opportunities to museum visitors and personnel: user mobility, service personalization, and collaborative work.

ACKNOWLEDGMENT

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