A Trustworthy System with Mobile Services Facilitating the Everyday Life of a Museum

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ABSTRACT

A museum is an environment where users with different needs interact with each other and museum content. The need of trustworthy digital services facilitating museum management and guidance is a necessity. Nowadays mobile devices are powerful and popular. A digital museum environment should adapt mobile services to be successful. But mobile devices suffer from security vulnerabilities. The proposed system supports trustworthy mobile services based on an extended role-based access control scheme for authorization purposes. This work investigates similar systems and modern smartphone technical capabilities, along with information collected by museum experts through interviews attempting to specify user requirements. An implementation of the proposed system is provided on the context of specific real-life scenarios addressing specific services needed by museum personnel and visitors. An evaluation follows comparing the presented system with other known museum systems having as criteria the services a system should provide to support real life tasks.

KEYWORDS
Digital Museum, Intelligent Services, Mobile and Portal Services, Mobile Devices, Museum Management

INTRODUCTION

Museums usually offer digital equipment to their visitors for exhibition dissemination purposes. Nowadays the trend is switching to Bring Your Own Device. The same logic can be used for museum employees facilitating the completion of tasks at their institutions (Johnson et al., 2015). Two important challenges in cultural web-based systems are long-term availability that includes protection of the stored content from unauthorized access and visualization and communication of the cultural content including the provision of personalized services to the end-user in a friendly way (Arnold, 2008). The efficient content authorization becomes more complex when mobile services are used for management, collection and dissemination of multimedia content due to the inherent characteristics of mobile devices (operating systems gaps and absence of access control and data security mechanisms) (Koukopoulos & Styliaras, 2013; Oberheide & Jahanian, 2010).

This work extends the methodology proposed in (Koukoulis & Koukopoulos, 2016) for the design and evaluation of mobile systems for museums. While authors in (Koukoulis & Koukopoulos, 2016) have as main goals the design of a mobile system that enhances visit experience for end users and facilitates museum personnel performing appropriate actions concerning museum visits, here it is proposed a system implementation with web portal and mobile services for the better support of management, preservation and dissemination actions in a museum. The proposed system tries to
enhance not only the visit experience, but all the basic interactions among the users of a museum, personnel or not, and the museum content, which take place in the everyday life like preparing a new exhibition. Specific services are proposed that allow museum personnel to perform common everyday actions for the efficient management of a museum, along with proper services for enhancing visitors experience. In order to design the proposed system services, the design goals of various mobile applications targeting museums were investigated considering the needs of various user groups and feedback was taken from museum experts based on their requirements for their everyday needs. In particular Paschou et al. (2013) is dealing with mobile multimedia, positioning and messaging services, Ruotsalo et al. (2013) utilizes a various set of services that communicate with each other to satisfy user needs and Kuflik et al. (2015) use services pre, during and post their visit.

An issue arose from such an investigation concerns the security of the stored multimedia museum content. The biggest challenge here appears to be the suitable user authorization for accessing stored content. In (Kodali et al., 2004) a general access control framework that accommodates discretionary, mandatory, and role-based access control models is used. Role-based access control model consists of a number of user groups/roles which are associated with specific operations that can be applied on specific content. Any user is assigned at least a user role and inherits all the permitted operations of the role. The proposed system applies an extended role-based access control model to keep up with the authorization needs of a museum. Recent years, there is a number of works in the literature that handle the authorization problem in cultural heritage domain using such an access control scheme. Koukopoulos and Styliaras (2013) applies an authorization mechanism on a system that offers mobile guiding services for cultural heritage sites, which is based on an extended role-based access control scheme. Additionally, an extended role-based access control model is applied on a multimedia participatory platform addressing cultural environments (Z. Koukopoulos et al., 2017).

The implemented system prototype is based on free technologies. MariaDB is used as DBMS for data storage, along with a filesystem located on an apache server. The authorization services have been implemented with Auth0. For the web portal and its administration, Single Page Application technologies are applied (Angular2+). The mobile application was created using Ionic Framework. For Web services PHP is used. In order to show how efficient is the implementation of the proposed system, several common museum scenarios are developed testing the proposed services in terms of ease of use and trustworthiness. An attempt is being made to quantitatively evaluate the proposed system comparing it with other known museum systems (Pujol et al., 2013; Ruotsalo et al., 2013) and applications (Los Angeles County Museum of Art, 2016; Museum OnLine Inc, 2016; Smithsonian Institution, 2016; The Metropolitan Museum of Art, 2016) having as criteria the needed system services for real life scenarios support in a museum.

RELATED WORK

The tremendous progress in web technologies and communication devices has permitted the construction of intelligent environments (Fotopoulos et al., 2012; Meier & Lee, 2009). Such environments facilitate the needs of various areas of everyday life like emergencies (Feng et al., 2013; Mukherjee et al., 2016), assisted living (Brink et al., 2013) and cultural services (Koukopoulos et al., 2017). Intelligent environments support such needs based on specific services like data transportation (Zhang et al., 2017), dynamic discovery of desired services (Belgharb & Boufaida, 2017), user mobility (Borawake–Satao & Prasad, 2017; Kulkarni et al., 2017) and trust (Mhetre et al., 2016).

By June 2016 Google play’s store and Apple’s App Store hosted 1.3 and 1.2 million apps correspondingly. Those repositories contain a few thousand apps devoted to museums, professional or created by amateurs, paid or free, created by the institutions themselves or not. For example, “Museums in NYC” is a free app that offers information about museums in NYC (Androids Future, 2012). “Rodin Museum app” is a free app that informs about Rodin’s sculptures and allows sharing at social media (Acoustiguide Inc, 2012). The British Museum Lite is the free version of an app that allows a virtual tour at British Museum and provides maps, high resolution images and thematic...
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