

MDM based mobile services in universities

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Abstract :

Deploying of miscellaneous mobile services in universities is very popular topic. Conducted analysis of mobile services available in world universities proves their diversity and independence between each other. There is still no experience in developing complex of mobile services based on unified technology for such type of organizations. The article reviews a structured list of mobile services based on the analysis of services currently in use as well as introduces new specific services which can be implemented only based on mobile devices management (MDM) system usage. The article contains qualitative assessment of services relevance among three focus groups (students, teachers and administrative staff). Proposed is a complex of mobile services for higher education.

Keywords: *mobile services, BYOD, Mobile Device Management*

I. INTRODUCTION

World trends analysis in mobile technologies usage proves their vast integration into education in order to solve miscellaneous educational tasks and provide remote access to general and specific network resources and services of institution. Among mobile services supported by leading universities the most popular are the following: mobile version of institution web-site, mobile access to educational courses, timetable and e-library resources of the university, and miscellaneous information and help services.

Extreme increase in amount of applications and data which can be accessed with a wide variety of mobile devices makes deploying of Mobile Device Management (MDM) system very effective. MDM includes software that provides the following functions: software distribution, policy management, inventory management, security management and service management for smartphones and media tablets [1]. Not only does MDM manage mobile devices of the organization, but it also includes centralized functional system of data and applications security and management, as well as centralized system of information functions. MDM systems often support usage of employees' own devices to access corporate information resources and services of organization. Such approach is known as BYOD (Bring Your Own Device).

So, MDM based system together with BYOD approach allows to introduce new formats of educational work, supports new ways of using university areas, and helps to solve modern scientific, educational and creative tasks.

In this work, we propose to develop a university information system based on MDM and BYOD. Our work is divided into several phases. During the first phase, we compose a classification of services for education based on a review of existing university information systems. Then, we expand the classification with new services that become technically possible with MDM. We evaluate the services, including newly suggested, with a study with representatives from three focus groups, namely students, teachers, and administrative staff members. Finally, we discuss implementation of such a system.

Thus, the contributions of this paper are: 1) the proposed approach to build university information system based on MDM, 2) the classification of mobile services for education, including new MDM based services, and 3) the qualitative evaluation of services.

This rest of the paper is structured as follows. In the next section, we discuss background and related work. Then, we present a classification of mobile services for education, that includes both existing services and new MDM based services we propose. After that, we present a study conducted to qualitatively assess the services, both existing and new. Then, we discuss how the services could be implemented with MDM, and conclude the paper.

II. RELATED WORK

Nowadays, mobile and e-learning services are provided in many universities, e.g., Massachusetts Institute of Technology, Stanford University, Harvard University, Oakland University, University of Leeds, University at Buffalo, MGIMO University.

Mobile services in education are also an active topic in research. Several recent papers discuss use of mobile learning services in higher education [4, 5, 6, 7]. In [4], authors discuss a concept of m-learning, i.e., e-learning using mobile devices. Based on a study where students ranked different services, they conclude about the most popular services and the most important concerns. They discuss requirements and limitations of m-learning and claim that this approach will become more popular in future. In [5], authors conducted a survey of staff and students to study how mobile services facilitate higher education processes.

In [2, 3, 8, 9, 10, 11] authors analyze use of mobile services in areas other than education. In [2], authors discuss emergence and evolution of mobile services in various areas. As a result of their analysis, they present a taxonomy of mobile services based on 230 research papers. In [3], authors provide an extensive review of recent publications focused on using own mobile devices in information systems in higher education. They specially address issues related to policy creation, data security, user education and mobile learning. Use of mobile services is studied in other areas, such as tourism [8], medicine [9], public safety [10], and police [11].

Location services are also discussed in the literature. For example, in [6] authors provide a classification of mobile location services and discuss their future development. In [7], authors provide an overview of current practices of mobile services in education and discuss their possible benefits and concerns.

III. MOBILE SERVICES IN HIGHER EDUCATION

Mobile technologies are considered as a perspective trend of improving information technologies in education. A popular approach for a university IT-strategy is based on service model – a structured set of services performing miscellaneous functions and available for different groups of users (students, teachers, administrative staff). Analysis of such catalogues for different universities proves that sets of services for each university are individual. In this paper, we aim to create a structured set of services which can be realized using modern mobile technologies, including MDM systems.

During the first phase, we made a classification of existing mobile services. The process was organized as follows. First, we collected the data about services used in several leading universities, namely Massachusetts Institute of Technology, Stanford university, Harvard university, Oakland University, University of Leeds, University at Buffalo, MGIMO-University. After that, we analysed existing classifications of mobile services in education [3, 4, 5, 6, 7]. Then, we looked use of mobile services in other areas [8, 9, 10, 11].

In the second phase, we aimed to expand the classification with new services supported by MDM. Most importantly, MDM allows to access and control the devices directly. For example, it is possible to receive technical data, such as location data. Also, it is possible to control the access to network and information resources. We discussed these new technical possibilities with students, teachers and administrative staff of Information Technologies and Control Institute within Saint-Petersburg State Polytechnic University. We added new services appeared during the discussion into the classification made on the previous step.

A. *Classification of services*

The resulting classification is a set of 9 groups of services presented below. Newly proposed services are marked with (New).

- **General services:** mobile version of university web-site; clients for mobile platforms (Android, iPhone/iPad, Windows Mobile/Phone, etc.) providing access to university resources anytime and anywhere;
- **Information services:**
 - Library services: registration in the library; searching through the catalogue; online materials booking; access to educational and information materials.
 - Educational services: access to information and educational resources (audio and video courses, presentations, etc.); web conferences; catalogues of studying programs and courses; registration to courses (seminars, lectures, faculties, etc.), exams and online tests.
 - Help services: events calendar; phone book; contact information on departments, administrative offices, etc; emergency information.

- **Communication services:** e-mail; social media services; audio and video conferences; social networks; overall user groups notifications and information messages.
- **Access to mobile applications:** adding application stores (Apple AppStore, Google Play, etc.) and educational content into the structure of educational and research procedures to provide remote access to network educational and research resources with options to download, play, rate, edit them and to share experience in their usage.
- **Services based on geolocation:**
 - Indicating location on interactive map of the university: location on the campus area; possible ways of directions through the campus area with providing the most optimal one to get from one specific place to another one; nearby transport schedule; indicating the nearest places of interest on the campus area: classrooms (with corresponding classes timetable), libraries, student hostels, places to eat; parking information etc.
- **Mobile banking:** services based on using mobile device as identification and paying tool:
 - Payment for services, catering, facilities, etc.;
 - Personal balance management;
 - Reports on transactions.
- **Location based services** (including both outdoor and indoor positioning):
 - (New) Students, professors and staff registration on classes or meetings;
 - (New) Automated detection of persons attending the activity in progress (lection, seminar, meeting, etc.);
 - Automated download of information materials, documents and text messages on the device;
 - Option to edit interactive map by adding personal information: accidents on the campus area, places where unplanned meetings or other activities are held, etc.
 - Integrating location services with social networks: using worldwide popular social networks students, professors or other staff can join into virtual groups and track the location of groups' members with mobile devices.
- **Equipment access:** services based on possible access to miscellaneous devices within corporate network:
 - (New) Remote wireless access to miscellaneous devices (printers, projectors, multimedia devices), measuring/displayable equipment in educational and research work.

- **Services based on access to mobile devices' functions:**
 - Automatically securely remove corporate information from mobile devices («secure erase»);
 - (New) Lock and unlock mobile devices according to educational activities in progress;
 - (New) Lock and unlock sensors of mobile devices according to educational activities in progress.

IV. EVALUATION

A. Study Description

During the third phase, we conducted a questionnaire study to qualitatively evaluate the services and their relevance. The aim of the study was to understand if how people from potential focus groups (students, teachers, and administrative staff members) rate the proposed services. We included the existing services in the questionnaire as a reference point.

The questionnaire was conducted in the Institute of Computing and Control within Saint-Petersburg State Polytechnical University. We recruited respondents from three potential focus groups (20 students, 15 teachers, 11 administrative staff members). Each respondent received a list of services presented above and was asked to select services they would likely use. Practically, they had to assign a priority level (High, Medium, or Low) to each service.

B. Study Results

We calculated an average priority level for each group of services. Summarized results are shown in the Table 1. As shown in the table for each group of services at least one focus group has high (H) level of its priority.

TABLE I. Mobile services relevance

Services	Focus-groups		
	<i>Teachers</i>	<i>Students</i>	<i>Administrative</i>
General services	H	H	H
Information services	H	H	H
Communication services	H	H	H
Access to mobile applications	H	H	H
Services based on geolocation	L	M	L
Mobile banking	L	M	M
Location based services	H	H	M
Equipment access	H	M	L
Services based on access to mobile devices' functions	M	L	H

Commonly known services, such as general services, information services, communication services, and access to mobile applications, have high priority levels. Among newly proposed services, the location based and equipment access services are the most relevant. In general, for each service type there is at least one focus group that ranked it as high priority service.

V. IMPLEMENTATION BASED ON MDM SYSTEM

Some services from the list can be implemented (and has already been implemented in some universities) as independent services. However implementing services from the groups Equipment access, Services based on access to mobile devices' functions, partly from the groups Mobile banking, Location based services is only possible within MDM system.

Integration of MDM and BYOD approaches while determining university informatization strategy aimed to allow students, professors and administrative staff using their own mobile devices (smart phones, tablets, etc.) to access internet and general and specific remote resources and services of the university provides to MDM system the functions of information security, mobile devices management, data and applications access. Implementation of groups of services listed above is possible within MDM system which is aimed to solve the following technical and organization tasks:

- detect the type and technical capabilities of connected devices;
- apply group policies to set options and restrictions on mobile device;
- manage the mobile device access to corporate resources;
- lock sensors of mobile device (microphone, camera);
- lock and unlock mobile devices;
- information output from mobile devices to network equipment and displays;
- data exchange with user management systems
- authorized removal of corporate information (in case of mobile device was lost or stolen, for example);
- automatic location detection of connected mobile devices;
- centralized distribution of corporate applications.

MDM allows unifying the considered services by providing single security system and personified access to applications, public information and communication services. Also MDM makes it possible to implement services from the groups Mobile banking, Location based services, Equipment access, Services based on access to mobile devices' functions.

VI. CONCLUSIONS

Usage of MDM and BYOD technologies allows to develop totally functional complex of mobile services for universities including relevant services of the following groups: Information services, Communication services, Access to mobile applications, Services based on geolocation, Mobile banking, Location based services, Equipment access, Services based on access to mobile devices' functions.

The project devoted to MDM systems software development is being realized in cooperation by IBS Group Holding Ltd. and Saint-Petersburg State Polytechnical University

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