m-Governance in Higher Education institutions: Technology Infrastructure for Cutting-edge Connectivity to stakeholders

E.Ramganesh	Dr. E. Kirubakaran	Dr. R. Gobi
School of Computer Science and Engineering	*SSTP Systems*	*Dept of Computer Applications*
Bharathidasan University, Tiruchirappalli	*BHEL, Tiruchirappalli*	*NIT Trichy*
eramganesh68@gmail.com	*e_kiru@yahoo.com*	*gobi86@gmail.com*

Abstract: Despite its early stage, m-governance seems to have a substantial influence on the generation of set of complex strategies and tools for e-governance efforts and on their roles and functions. M-governance is inevitable. The number of people having access to mobile phones and mobile internet connection is increasing rapidly. The mobile access - anywhere any time – is becoming a natural part of daily life, and the Higher Education Institutions(HEIs) will have to transform their activities according to the demand of stakeholders with due efficiency. In that way, this paper explores the need for HETs to establish technology infrastructure for m-governance so as to facilitate their stakeholders. In this regard, a framework has also been presented.
Key words: m-Governance, Technology Infrastructure and m-Governance framework.

I.   Introduction

m-Governance is not a replacement for e-Governance, rather it complements e-governance. e-Governance is the use of information technology like WAN, Internet and mobile computing by Governance agencies, to transform private businesses and public agencies, as well as to empower the citizens. m-Governance, on the other hand, is the use of mobile or wireless to improve Governance service and information "anytime, anywhere". Mobile applications also rely on good back office ICT infrastructure and work processes such as governance networks and databases, data quality procedures, transaction recording processes, etc. But it is just the tip of an iceberg: just the final delivery channel to the citizen. Underneath is a complex infrastructure that is required in order to make final delivery device work. Providing information to the stakeholders of an University is not a trivial activity. It is the foundation of stakeholder empowerment. Without relevant information stakeholders are unable to form intelligent opinions and, thereby, are unable to act on the issues before them meaningfully. Mobile devices provide an important access channel for an university to reach stakeholders (U2S). For example, an educational administrator of an affiliated college which is far off can choose to receive SMS alerts for a variety of e-services such as: governance activities, research & consultancy, examinations, curricular activities, renewal of recognition, publication, fee payment reminders etc. from the University. m-governance applications can be seen as a tool for more efficient administration and flows of information mainly within government at all levels. Mobile phone applications for good governance is more about using the mobile technology to make government ministries "*even more accessible and citizen-centric by extending the benefits of remote delivery of government services and information to those who are unable or unwilling to access public services through the Internet or who simply prefer to use mobile devices*" (World Bank, 2007). Mobile phones make it possible to create a bottom up participation and ultimately – what m-governance is all about – empowerment.Bringing the mobile internet to the mobile devices is not an easy task. These devices have limitations in terms of size (small displays and keyboard) and low memory. Also, the technologies are yet to prove themselves with high speed and smooth transmissions without any disconnection. Various wireless standards and handset compatibilities remain to constitute important challenges to real world business applications and implementations on the mobile internet. In developing countries where internet access rates are low but mobile phone penetration is growing rapidly, has triggered the government to develop m-Government as an addition to e-Government. The development of e-Governance has begun since many years ago in many countries, some are successful, and some are still being developed, while m-Governance nowadays, is in the early stage of development and may define as a new strategy to utilize all kinds of mobile devices, applications and services. m-Governance must be set to provide the additional features for the integration and exchange data communication, especially for the higher education institutions that have made a lot of investment in e-Governance implementation. The synergy between both of them may become a new method for the interaction and communication between HEIs and stakeholders. During the past ten years, we have witnessed how mobile phones and the simple functions of voice and text messaging (SMS) can empower citizens and affect the way citizens interact with each other and with the society as whole. Mobile phones are also thought to open up for a deepened democracy through citizen participation and insight into state affairs, through influencing the political decision making process, and helping in holding governments accountable. It is

imperative for higher education institutions in the present scenario to build up technology infrastructure for effective dissemination of their goods through m-governance.

II. Rationale: why mobile phones?

There is no need to re-emphasize just how appropriate information and communication technology (ICT) systems (here computers and internet) are for the capture, processing, storage, organization and presentation of data and information. ICT used as a tool to improve good governance, ie. e-governance, facilitates openness and transparency and creates a freer flow of information between departments, institutions and layers within government. ICT, as seen in many developed countries, also facilitates a freer flow of information between government and citizens and opens up for opportunities for citizens to participate more directly in influencing decisions that affect them. But how is about mobile phones as the new interface between government and citizens? Can slow government processes be combined with mobile phones that are ever-changing, quick and direct in their usage? Why mobile phones? Is it not just another hype that often accompanies the latest technical breakthroughs? We have witnessed that mobile phones help to create an informative, connected, innovative, participative and converging society all over the world (Hellström 2009).

1) Access. Penetration rate is ever increasing and even more have access through shared usage and ownership. Related to access is that mobile phones add the dimension 'anywhere and any time': due to their mobility and that mobile phones are switched on most of the time, which opens up for new possibilities.

2) Reach. Again, due to its mobility and network infrastructure, mobiles can reach areas where there is no other ICT infrastructure (like internet, fixed lines).

3) Adoption. As mobile phones more and more become an integral part of people's lives, m-commerce, m-government and m-x will be the the normal way of doing things. Further, there is an increasing public demand for mobility and easy access to services.

4) Interaction. Mobile phones make it possible for real-time, two-way dialogue as opposed to
radio, brochures, posters, public speeches etc.

5) Costs. The relatively lower cost of mobile phone technology versus internet technology has
lowered the entry barriers for poor people. Affordability is still a concern though – somebody needs to pay for the infrastructure, communication and services

6) Efficiency. Due to high access, its reach, good adoption and real-time interaction mobile phones offer efficient solutions to governments communication challenges

7) No other option? In developing regions with poor infrastructure, going mobile may be the only viable option.

## III. Benefits of M-governance in a University

M-governance solution in the field of educational sector has changed the total policy of administration, which is designed to make the system easy accessible, time saving and economic. It is an integrated solution in the education sector that facilitates the processing and maintenance of large volumes of information such as: student's registration, admission, personal information, fees, classes, time table, transport, attendance, library, examinations, performance, grades, hostels, security, reports, management, expenses, staff details, salary etc. among various departments in an institution. However the following are the advantages of m-gov:

* Improving the efficiency of the various departments and lessen replica
* Preparation of reports becomes easy and faster.
* Easy online information and submission of forms and payment also becomes almost immediate.
* Getting connected with the management, faculty members, students and administrative staff to the each other more easily leading to enhanced efficiency in service by the way of faster diffusion of information economically .
* Equal opportunity to access the information regardless of one's physical location and removing all the distance barriers.
* Leading to reduction of transaction costs, time and space
* Efficient use of Human Resource

IV. M-Governance Frame Work of an University: Technology infrastructure

The broad framework for mobile-governance involves the citizen by giving the freedom and flexibility of accessing and interacting with the urban local body in multiple convenient and personalized ways. The framework discussed to creating e-chains to enable e-governance through embedded technologies (Sundar, D. K., Garg, S. 2003) is adopted and modified in the m-governance context for ULBs.

M-Governance in a Higher Education Institution: A framework with Technology Infrastructure
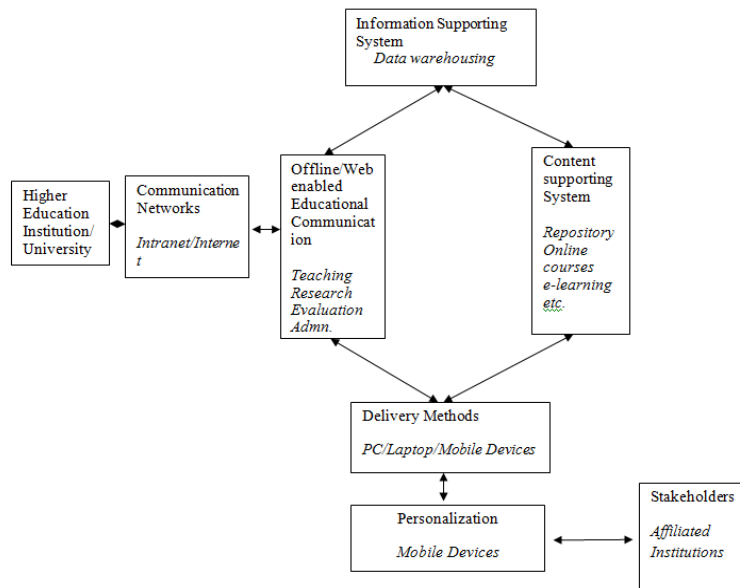
It can be seen, broadly, by stakeholders or affiliated institutions as (i) activities that happen with in an University, and (ii) their interaction(s) with the University. The main components of it are service delivery mechanisms (both information and material requirements), which should address the highly personalized needs of stakeholders or affiliated institutions. These components, broadly, are Thin/Thick clients, Personalization: Smart card/PDA, facilitated by multi mode access: WLL, Wi-Fi, Blue-tooth etc. There are several options available for selection of appropriate technologies for the different components of m-governance, in terms of hardware and software to facilitate the m-governance initiatives. The components, in brief, are communication networks, computing platforms (in-house use, i.e., servers, desktops, handheld – mobile devices, besides user kiosks), software (infrastructure -web servers, databases; and applications). Several critical technologies are used in this architectural framework:
• The Semantic Web for web-based services
• Knowledge management and sharing through Ontologies
• Mobile Devices for access at the doorstep
• Security and Authentication

The next generation of the worldwide web is expected to move towards the "Semantic Web", which helps define a common framework for sharing and reuse of data across applications, enterprises and community boundaries. So far the Web has developed most rapidly as a medium of exchange documents for people rather than as a medium of exchange for data and information that can be processed automatically. The Semantic Web will bring structure to the meaningful content of Web pages, creating an environment where software agents roaming from page to page can readily carry out sophisticated tasks for users (Berners-Lee, et al., 2001), To explore the potential of associating web content with explicit meaning, rather than rely on natural language processing to extract this meaning from existing documents, this approach requires authors to describe documents using a knowledge representation language (Heflin, Jeff, 2001).The World Wide Web Consortium has published detailed recommendations for Resource Description Framework (RDF) and OWL (Web Ontology Language) whereby RDFs are used to represent information and to exchange knowledge on the web and OWL is used to publish and share sets of terms, called ontologies, supporting advanced web search, software agents and knowledge management (McGuinness, D. L., 2004). Since our m-governance architecture is inherently web-based, the use of the semantic web and ontologies is appropriate for the development of our applications and services. It will also enable us to share these knowledge bases across different urban local bodies with minimum customization.

V. Creation of Mobile Services Delivery Gateway (MSDG)

MSDG is the core infrastructure for enabling the availability of public services through mobile devices. The objective of creating the MSDG is to put in place government-wide shared infrastructure and services to enable rapid development, mainstreaming and deployment of m-Governance services. It will enhance interoperability across various public services as well as reduce the total cost of operation of m-Governance services by providing a common pool of resources aggregating the demand for communication and e-Governance services, and act as a platform for various Government Departments and Agencies to test, rapidly deploy, and easily maintain m-Governance services across the country. In that way a core infrastructure similar to MSDG must be created by an University to extend its services to stakeholders and affiliated institutions. The infrastructure may be based on open standards and will be developed as a cloud-based service.

MSDG shall support the following delivery channels for development and deployment of mobile-based applications. As the mobile-based technologies are constantly evolving, more channels may be added in future as the need arises.

- SMS (Short Message Service)
- IVR (Interactive Voice Response)
- WAP (Wireless Application Protocol)
- USSD (Unstructured Supplementary Service Data)
- CBC (Cell Broadcast)
- SIM Toolkit (STK)/Dynamic STK, 3G-Video
- Others (Wi-Fi / WLan etc.)

To ensure successful implementation of the platform with requisite levels of security and redundancy, following actions will be taken:

a) End User Interface: End-user devices include landline phones, mobile phones, smart phones, personal digital assistants (PDAs), tablets, and laptops with wireless infrastructure. Mobile applications developed shall take into consideration appropriately the wireless-device interface issues, such as bandwidth limitations, micro-browser and micro-screen restrictions, memory and storage capacities, usability, etc.

b) Content for Mobile Services: Due to lower-bandwidth and smaller-screen characteristics of mobile devices, successful development and deployment of m- Governance will require development of separate mobile-ready content. Similarly, to meet the needs of all the potential users, the applications will need to be developed in the relevant local languages for the various channels of delivery. Open standards and open source software, to the extent possible, will be used to ensure interoperability and affordability of the content and applications developed.

c) Mobile Applications (Apps) Store: A mobile applications (m-apps) store will be created to facilitate the process of development and deployment of suitable applications for delivery of public services through mobile devices. The m-apps store shall be integrated with the MSDG and it shall use the MSDG infrastructure for deployment of such applications. It is proposed that the store will be based upon service oriented architecture and cloud based technologies using open standards as far as practicable**.** The open platform will be developed and deployed in conjunction with the MSDG for making the additional value added services available to the users irrespective of the device or network operator used by them.

d) Application Programming Interfaces (APIs) for Value-Added Services (VAS) providers: MSDG shall offer suitable APIs to VAS providers with appropriate terms and conditions to ensure interoperability and compliance with standards for development of applications for delivery of public services.

e) Mobile-Based Electronic Authentication of Users: For electronic authentication of users for mobile-based public services, MSDG shall incorporate suitable mechanisms including Aadhaar-based authentication. This will also help in ensuring appropriate privacy and confidentiality of data and transactions.

VI. The Emergence of Mobile Internet

Conventionally, anywhere – anytime voice communication has been one of the major factors for the growth of mobile phones. Data communications however is now becoming very attractive to many consumers and business users. The technology and the speed of the mobile internet has evolved through various Gs (generations). Initially mobile telephony systems were analog, circuit-switched. Voice links were poor, capacity was low, and security was almost non-existent. Then comes the second-generation (2G) protocols using digital encoding such as GSM and CDMA. These technologies are in use around the world and support high rate of voice but limited data transfers. They offer auxiliary services such as data, fax and SMS. The next generation technologies and protocols, (2.5G) extend 2G systems to provide additional features such as packet-switched connection (GPRS) and enhanced data rates. Third-generation protocols support much higher data rates, and are intended primarily for applications other than voice. 3G applications, at a limited scale, have already started in

Japan, Europe, part of Asia/Pacific, and in the US. Full fledged 3G is expected to support bandwidth-hungry applications such as full-motion video, video-conferencing and full Internet access (Sadeh, 2002, Wallace et al, 2002). When designing m-governance applications, another important aspect of the architectural framework is to really understand and capture the existing knowledge about processes and workflows. What is working, what is not working, how could things be done better? Next step is to map the solutions into an abstraction that then can be translated into applications. Too often a mobile "solution" is designed for a problem that never existed in the first place (and "too many solutions looking for problems"). Applications should be developed having the end users point of view, not the application as such. M-governance enables the students & administrators to access easily, to use new class of quality of services and to provide multi-channel service delivery system. The vision of M- governance is to renovate service deliverance through the use of IT and Multimedia for performing administrative activities.

VII. Conclusion

A pilot mobile based admission procedure was initiated by Shahjalal University of Science and Technology (SUST) in 2009 that has generated good response triggering government directives to implement this for all universities in the country. From 2010-2011 sessions all public universities implemented mobile based admission, fees and result system following government's directive. Detail case study for SUST admission procedure and college admission procedure will be discussed in the Case Study and Analysis section (chapter three and chapter four). Besides the trigger from government side, many national and international organizations like US AID, The World Bank, D-Net are working on facilitating mobile governance by initiating teachers training (on providing digital and interactive education), distance learning (through wireless connection in computer & mobile phone, community radio, television), content development for mobile and computer based adult learning, e-book and so forth. Following government recent development strategy the initiatives were designed in a motive to reduce travel and travel cost replacing by flexible communication (A2I, 2009).

When analysing the potential for m-governance within an university and how it can be adopted, it is important to examine the value chain which is created by the various entities that provide the products and services required in the process of constructing a mobile solution and to identify strengths and address gaps. Following an effective application of the model, mobile initiatives would be jumpstarted by positive regulatory policies and standards, and through resourceful funding strategies. The foundation for these initiatives is built on quality systems and databases, which are then utilised in a mobile application that has relevance to users. Missing pieces can derail the process, but innovative technologies, new application options and an updated paradigm of integration are generating effective alternatives, often eliminating the complex task of building new systems. Access technologies and mobile devices that support users are rapidly improving. Mobile service providers are responding at a rapid pace to a competitive environment. Hence modest efforts must be made in Higher Education institutions to build adequate technology infrastructure to establish mobile governance for transparency and efficiency in administration.

References

[1]. Berners-Lee, T., Hendler, J., Lassila, O., (2001), "The Semantic Web", Scientific American, May 2001.
[2]. Heflin, Jeff, 2001, Towards the Semantic Web: Knowledge Representation in a Dynamic, DistributedEnvironment, PhD Thesis, University of Maryland, College Park.
[3]. Hellström, J., 2009 forthcoming. Mobile Democracy – Challenges and Way Forward. In Big Brother and Empowered Sisters, Uppsala University
[4]. McGuinness, D. L., & van Harmelen, F., eds. 2004, OWL Web Ontology Language - Overview , W3C Recommendation 10.
[5]. Sadeh, Norman, 2002, M-Commerce: Technologies, Services and Business Models, John Wiley and Sons, Inc, Canada and USA.
[6]. Sundar, D. K., Garg, S. 2003, Creating e-Chains to enable E-Governance through Embedded Technologies, Proceedings of First International Conference on E-Governance, 2003, New Delhi,India
[7]. Wallace Paul (et al), 2002, I-mode developer's Guide, Addison Wesley, Pearson Education
[8]. World Bank, 2007. World Bank e-Development Thematic Group M-Government Conference –
[9]. November 29, 2007 – Background Note. URL http://siteresources.worldbank.org/EXTEDEVELOPMENT/Resources/20071129