

Handbook of Research on E–Services in the Public Sector: E–Government Strategies and Advancements

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Chapter 3

Voice-Based E-Learning Approach for E-Government

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ABSTRACT

Government establishments are most times highly involved in different reorganization programs. The processes in e-Government are diversified and complex, hence the need for an appropriate training and learning strategy for governmental employees. Changing business processes and organizational structures always mean that the personnel have to be familiar with the changed procedures. Consequently, the employees need to be trained to develop capacity for new responsibilities. Existing methods of learning and training do not make provision for certain category of employees such as the visually impaired. They do not provide an alternative learning platform for government of employees that are not physically challenged. Many studies have demonstrated the value of several learning platforms, including mobile learning (m-Learning) but with the problems of access barriers and streamlined participation of most learners. The purpose of this chapter is to propose a voice-based e-Learning system, also known as voice-learning (v-Learning) as a variant of the m-Learning with particular relevance for the visually and mobility impaired learners. V-Learning makes possible ubiquitous learning in e-Government and provides additional capacity and speed of response to help facilitate change. Cost reduction is also achieved and there is no shortage of teachers.

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INTRODUCTION

At the end of this chapter, readers will understand the:

- meaning of e-Government and voice-based e-Learning
- concept of voice-based e-Learning approach for the visually impaired
- technologies for voice-based e-Learning in e-Government
- benefits of voice-based e-Learning systems in e-Government
- challenges in voice-based learning in e-Government
- recommendations for the implementation of voice-based e-Learning in e-Government

BACKGROUND

E-Government is the use of Information and Communication Technologies (ICT) to support government operations and service delivery in a responsive and cost-effective manner (eGovt, 2005). It facilitates administrative and managerial functions, providing citizens and stakeholders with convenient access to government information, facilitating interaction and transactions with stakeholders, and providing better opportunities to participate in democratic institutions and processes (Anttiroiko, 2008).

The use of ICT in government activities has become a common phenomenon in recent years. In the late 1990s, a unique concept known as electronic government (e-Government) was introduced in the field of public administration (Hasan, 2003). ICT has been identified as a tool that provides the services of governance in the areas of e-Administration, e-Voting, e-Democracy, e-Health, to mention but a few. To date, various technologies have been applied to support the unique characteristics of e-Government, includ-

ing interactive voice response (IVR), voice mail, email, web service delivery, virtual reality, augmented reality, etc.

The web and other technologies have shown great potentials for effective and efficient tools that collect, store, collate and manage voluminous information. The most current information can be uploaded and downloaded on the Internet in a real-time. Government can also transfer funds electronically to governmental agencies or provide information to public employees through the Intranet or Internet. Additionally, governments can perform many routine functions more easily and quickly. Web technologies also facilitate government links with the citizenry for services, political activities, other governmental agencies and businesses.

E-learning is a method of facilitating and enhancing learning based on the use of computer and communications technology. The term is commonly used to refer to learning or training that is delivered over an Intranet or the Internet (“e-Learning Glossary”, 2008). There are different categories of e-Learning environment. The first category is the traditional formal education. Here, teacher and students have to be physically present in a classroom. The major communication means between the teachers and students is face to face. Distance education is the second category; with the development of communication network technologies in the industrial age, teachers and students are separated by space and time. Communication between teachers and students is achieved by using traditional mail, phone, radio and television.

The electronic revolution and the invention of Internet gave rise to e-Learning that has become the third category. Since then different types of media like text, audio, video, hypertext simulations and two-way communication have been used commonly in education. The m-Learning that constitutes the fourth category involves the use of mobile communication tools like mobile phone,

pocket PC, etc. M-Learning can take place anytime, anywhere with the help of a mobile device.

Voice-based e-Learning, also known as voice-learning (or v-Learning) is proposed in this chapter as a variant of the fourth category (m-Learning) with particular relevance for specific groups in the populace. It means the use of land or mobile phone to access learning content on the Intranet or Internet depending on network coverage availability. It uses technologies such as speech recognition and text to speech (TTS) conversion to create a user interface that enables users to navigate through a dialogue system using telephone and voice commands. Voice-based applications have been developed in several areas such as e-Learning (Azeta *et al.*, 2008a; Gallivan *et al.*, 2002), banking transactions (Azeta *et al.*, 2008b) and a lot more.

Voice-based e-Learning in e-Government is defined as the use of speech technologies to deliver learning and knowledge management content to government employees. For instance, as a staff of a government establishment at any level, whether local, state or federal, one may be scheduled to attend training at the federal government headquarters in the capital city. Lectures are provided through voice interface. To participate, employees are required to dial a telephone number to access the learning materials in a central server using a mobile or land telephone that will connect the caller to a government learning content information management system (GLCIMS).

The processes in e-Government are dynamic hence the need for an appropriate training and learning strategy for employees of government. Techniques exist for learning but they do not cater for employees that are visually impaired nor provide alternative learning platform for employees that are not physically challenged. The purpose of this chapter is to propose a voice-based e-Learning system to serve as an alternative learning platform for normal employees of government, and in particular to suit the physically challenged

learners such as the visually or mobility impaired government employees, i.e. employees with partial or no sight, or inability to move from one place to another.

VOICE-BASED E-LEARNING APPROACH FOR THE VISUALLY IMPAIRED

There is no gainsaying the fact that technology is changing fast. It is changing the way we do things and the pace at which we do them. Internet connected Personal Computers (PCs) have become commonplace in our educational institutions and workplaces. Indeed, many people, students, government employees and citizens carry laptops about for their uses which afford them the opportunity to learn and show their computer skills daily.

Those individuals, who, for various reasons, cannot make use of modern computer systems efficiently, will be increasingly left behind in terms of educational opportunities, job skills and employability. Those with physical disability (particularly the visually impaired) are not considered in the context of usability of these technologies.

Voice-based learning is also known as assistive technology. The World Wide Web Consortium (W3C) defines assistive technology as software or hardware that has been specifically designed to assist people with disabilities in carrying out daily activities (Adaptive, 2005). These technologies aid the learning process for learners with disabilities.

Every democratic government should consider the possibility of providing education to her citizens, particularly the physically challenged, and ensuring that people with visual disability in particular can access government information and services with ease. More so, government employees that are visually impaired should be able to benefit from online training using voice technologies.

TECHNOLOGIES FOR VOICE-BASED E-LEARNING IN E-GOVERNMENT

This section examines a number of key technologies used for voice-based e-Learning in e-Government.

VoiceXML also known as voice extensible markup language, is one of the tools recognized by the W3C for building speech applications that can serve educational purposes and provide better accessibility to users (Chin *et al.*, 2006). An e-Learning system that can be provided using speech technology is one that delivers basic teaching by simply listening. For example, students can check their scores or listen to lecture notes by calling a particular telephone number through IVR. Some learners have used speech recognition systems successfully for their studies and for exams, and the use of this technology has helped them to overcome their physical disabilities and go on to higher education (Paul, 2003).

The software architecture of voice-based e-Learning allows users to access the learning content through mobile and land phone. Figure 1 contains software architecture of voice-based e-Learning system. Access to the system is per-

formed through the presentation tier using the registration information of learners. Security management also guarantees that the administrator authenticates all registered learners by issuing a pin for login. The business logic tier provides an interface between the presentation and database tier. It contains the voice gateway and the various modules of the application. The database tier stores and provides data access to information in the voice-enabled e-Learning system.

Similarly the hardware architecture for voice-enabled e-Learning system consists of client devices, servers and database (see Figure 2).

Client Devices

The client devices include mobile devices such as mobile phones and personal digital assistants, land telephones, etc. The mobile device carry out two main functions. First, the mobile device is used to access information and services provided by the web server through the voice gateway. Second, the mobile device is used to connect to e-Learning by dialing a telephone number. The land telephone can also be used to connect to the application.

Figure 1. Software architecture of voice-based e-learning for e-government

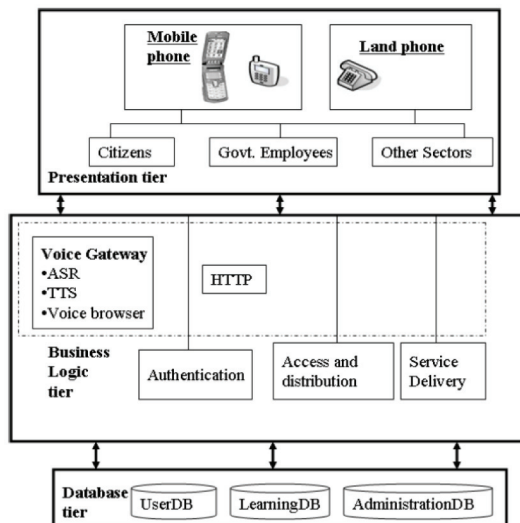
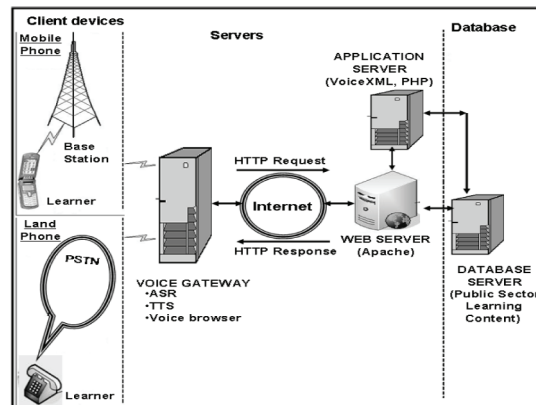


Figure 2. Hardware architecture of voice-based e-learning for e-government



Servers

There are three components of the servers: the voice gateway, application server and web server. The voice gateway is responsible for communicating with the user over the telephone and performing telephony tasks. The voice browser in the VoiceXML gateway collects speech input from the user over the telephone and presents it to the inner components of the VoiceXML gateway for processing. The voice browser also presents the output to the user in the form of spoken words over the telephone. In some cases, voice server and application servers can co-exist in one server in order to reduce dependency on the Internet link between the two servers (Qureshi, 2007).

Voice Browser: A voice browser is the human machine interfacing component of any speech driven voice application. A voice browser provides an interface between the caller and the different components of the voice server.

Automatic Speech Recognition (ASR): ASR is also called speech recognition engine and plays a major role in the development of today's computer telephony applications. Its main purpose is to convert human speech into text form that the application can understand. Speech recognition is the other end of the spectrum that provides assistance to learners with disabilities.

This technology has become so advanced that it has found its way into mainstream automotive systems, aiding in the hands free operation of in-car navigation systems. This software has to understand a multitude of voices in a variety of pitches and languages. Indeed a single voice can vary significantly from day to day, whether due to mood, or the effect of a head cold.

Text to Speech (TTS): TTS also known as speech synthesis are the most recognized form of adaptive technology. They provide exactly the reverse of the speech recognition process: that is converting text to speech. ATTS system announces text provided by the application to the caller in the form of spoken words. They are a necessity for the blind or vision-impaired learners to successfully navigate an e-Learning environment (Adaptive, 2005).

Web Server: The web server stores the actual middle-ware application (i.e. Apache) that connect the front-end and back-end interfaces.

Application Server: The application server stores the actual value-added information and content that subscribers wish to access. In this chapter, VoiceXML and PHP have been used for the development of the e-Learning application that is hosted in the application server.

Database

The database contains the MySQL database server which houses the data for the public sector learning content management.

BENEFITS OF VOICE-BASED E-LEARNING SYSTEMS IN E-GOVERNMENT

Voice-based e-Learning systems have the following benefits (Ally, 2008):

- Learners can learn from anywhere.
- Learners can learn at anytime.
- Learners are in more control of their learning.
- Course materials are easy to update.

The other benefits of voice-based e-Learning systems include (Aio, 2008):

Capacity Development

Voice-based learning has the potential to transform learning in government for normal employees and those with visual impairment. Revolutionary change in the sector is creating ever-changing knowledge and skills requirements, and traditional approaches to training and learning are struggling to keep up.

There is the need to increase training and development capacity for members and officers of government. It is unlikely that classroom-based delivery alone can provide sufficient capacity to respond within budget and schedule. V-learning can provide additional capacity and speed of response to help facilitate change.

Change

In a climate of change, new initiatives and information can be picked up quickly and consistently

across an organization. How quickly people can get up to speed and contribute effectively can either accelerate or suppress change.

This speed to competency may be difficult to achieve with large, geographically dispersed organizations such as local, state or federal government offices nation wide. The challenge of time, cost and logistics of bringing people together can be prohibitive, particularly with government's due process policy which makes it difficult to pull employees away from their jobs to off site training sessions. This usually results in delays and an inconsistency in the message delivered.

With voice-based online technologies, voice learning can be realized faster and more efficiently than existing learning methods. Voice-learning can achieve just-in-time learning with greater reach irrespective of location (whether on the move, at home or work), speed of response and consistency of message.

Cost Reduction

Data from the Chartered Institute of Public Finance and Accountancy (CIPFA) (Aio, 2008) suggest that government employees across England, Scotland and Wales spend £296 million on training per year, averaging around £150 per employee. With learning requirements growing, and more people needing to be trained in more areas, this is simply not enough to keep pace with change.

While claims that voice-learning is a cheaper form of training delivery can be misleading due to initial development costs, voice-learning can reduce training related expenses such as travel, accommodation and facilities. It can also provide economies of scale at higher learner volumes, as the cost of each additional learner is negligible once the materials have been developed and hosted in a central server.

Assume that 20,000 staff in government requires health and safety training each year. The cost of delivering training to these staff using conventional classroom training is estimated at

£86 per user for a one-day course. This equates to £1.72 million for 20,000 staff. An equivalent online voice learning course could be developed for £100,000 (Aio, 2008). However, this course can be hosted in a web server at virtually little cost to government. The course is also available online at any time a person needs it; and can be updated centrally so that staff always has access to the most up to date materials. These financial benefits accrue to the whole of government establishments engaged in the training that would no longer have to incur the costs of delivering this training through the classroom or other forms of learning.

Even if only five per cent of government employees training is considered and access provided through voice online, the savings to government could be in excess of £30 million per annum. This represents a return on investment of over 600 per cent and also enables a far greater number of staff to be trained with the same or less resources.

Stop Gap for Staff Shortage

The existing learning methods, particularly the face to face, etc, have some support from training schools and teachers. There are growing staff shortages in schools while the demands for teachers will continue to increase. Digital literacy is critical for future generations if poverty eradication is considered a key factor of government agenda, and this places added pressure on government in a democratic society.

Voice-learning as a component of e-Learning is being deployed as a means of fuelling the expansion in training institutes/schools within resource constraints. Deployed effectively, voice-learning could offset the lack of alternative resources for normal learners, while providing the visually impaired learners with a more participatory educational experience. Voice-based learning methods therefore serves as an assisted technology for the disadvantaged learner particularly the visually and mobility impaired learner.

CHALLENGES OF VOICE-BASED LEARNING IN E-GOVERNMENT

Illiteracy and Lack of Awareness

In many democracies, government's targets for capacity building and e-service delivery have major implications for staff development, literacy of officers, members and the community at large. To deliver and access e-enabled voice-based learning materials will require a new level of competence and awareness with ICT on a huge scale.

To use voice-based system, users will need basic competencies and awareness in mobile and land phone usage. Government employees will need the skills to access the e-training services effectively, and voice-learning can also provides a performance support function. Many organizations for example have begun to provide e-learning on their websites to educate customers on their services. There are the complexities of some users having to develop the basic ICT skills to even begin to use voice-learning, and while there are products and programs relating to "learning to learn on a voice-enabled mobile phone", this may require a blended model with face-to-face sessions to prepare people for voice-learning.

High Costs of Voice-Learning Development

While voice-learning can appear to be the best option for specific learning requirements, costs of development can be prohibitive if provided through a service provider. One hour of bespoke voice-learning content from an external supplier can cost an average of £15,000, an amount that most government authorities can scarcely afford. A cost-effective alternative would be to develop materials and content internally and employ the services of an ICT administrator to manage the learning content that will be accessed through voice. This will serve as a remedy since most

government authorities do not possess the required skills and knowledge to make it work effectively.

Resistance from Government Employees

There can also be resistance from government employees (the learners) as they are used to attending classroom sessions outside of their office station, which bring about some financial benefits. Such cultural expectations will need to change over time. Another level of resistance may arise from the perception of restrictions of mobile devices in terms of output and input capabilities. Mobile devices often have limited screen display sizes and limited capacity to support audio and video data, and also impose restriction on user input. Some learners may prefer to see the teacher face to face or view graphical information of what is taught. A lot of effort towards enabling mobile devices to access the web has been made (Alimadhi, 2002).

Since every society has different needs and priorities, a one size fit all model does not exist for e-Government and universal standard for e-Government readiness does not exist. Each society and government's readiness for e-Government will depend upon which objectives and specific sectors it chooses as priorities, as well as the resources available at a given point in time, which might depend on budgetary constraints, policies, etc. The necessary pre-conditions for e-Government depend upon a society's most important needs. For example, the level of infrastructure, legal framework and human capital needed for e-Government vary with the objectives being pursued.

Just like any government reform effort, political will is required to implement every e-Government project. Without the active political leadership, financial resources, inter-agency coordination, policy changes and human effort required to plan and implement e-Government will not be sustained (e-Gov, 2002). Political will exists when senior decision-makers have the resolve to exercise leadership in the face of opposition and setbacks.

Civil servants may resist e-Government projects, and may refuse to adopt new procedures. This problem may be more severe in developing countries where human resources may be less robust, the economy less stable and other job opportunities less plentiful.

SUMMARY AND RECOMMENDATION

In this chapter, we have proposed a voice-based e-Learning system as a variant of the m-Learning with particular relevance to the visually impaired learners. If citizens are deprived of expressing their viewpoints and have them represented in government, then individuals won't be able to exercise political powers that would help shape their community and country. Democratic government should provide an electoral law to support voice learning for persons who are physically challenged and are not able to participate in learning for reasons of inability to move from one place to another as a result of some forms of disability.

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