

Labor Integration of Deaf People Through a Cloud-based Platform

Amparo Jiménez¹, Amparo Casado², Javier Bajo³, Fernando De la Prieta⁴ and Juan F. De Paz⁴

¹ Faculty of Computer Science, Pontifical University of Salamanca,
C/ Compañía 5, 37008, Salamanca (Spain),
Email: ajimenezvi@upsa.es

² Faculty of Social and Humanities Science, Pontifical University of Salamanca,
C/ Compañía 5, 37008, Salamanca (Spain),
Email: acasadome@upsa.es

³ Department of Artificial Intelligence, Technical University of Madrid,
Campus Montegancedo, Boadilla del Monte, 28660, Madrid (Spain),
Email: jbajo@fi.upm.es

⁴ Department of Computer Science and Automation Control, University of Salamanca,
Plaza de los Caídos s/n, 37008, Salamanca (Spain),
Email: {fer, jbajope}@usal.es

ABSTRACT

This paper presents a cloud-based platform aimed at obtaining an on-line workspace to provide facilities to inform, train and evaluate the competencies of disabled people, and more specifically those skills required to facilitate the labor integration of individuals with auditory disabilities. The platform also focuses on providing training processes that facilitate the incorporation of disabled people to labor environments. The platform presented in this paper has been tested in a real environment and the results obtained are promising. This platform presented in this paper has been tested in a real environment and the results obtained are promising.

Keywords: Disabled people, auditory disability, competence, intelligent systems, learning and training processes

Mathematics Subject Classification: 97C70, 97U50, 68M14

Computing Classification System: I.2.6, I.2.11

1. INTRODUCTION

Education and training for disabled people has acquired a growing relevance during the last decade, especially for labor integration. Information and communication technologies play a very important role in this evolution. Disabled people represent a considerable percentage of the current population and require special education. This study presents a research project, carried out during past year that was focused on two different realities: professional training and proper professional performance with the special needs, such as auditory disabled people, of some people with difficulties to access to employment.

Within this study, the target term auditory disabled refers to a person on with hearing difficulty that can be alleviated with technical aids (FESORCV) [FESORC, 2001], as well as Prieto indicates [Prieto, 1999]. The study started with the selection of a target group of deaf people in a specific job profile and its performance: *Auxiliary Operations and General Administrative Services*. Subsequently, a technology-based training tool had developed which allows the disabled people to effectively develop their professional performance, as well as to improve the professional training previous to the integration into the labor environment. In order to perform a proper design of this professional guidance, it is necessary to detail and analysis the specific characteristics of the position, profile and skills associated with their good work performance. These skills have to be acquired by the worker, by means of professional qualification, in order to achieve the goals of the position.

Thus, we propose a cloud-based platform that focuses on obtaining on-line workspace for exchanging digital contents in an easy, intuitive and accessible manner. The main objective of the platform is to provide facilities to inform, train and evaluate the competencies of disabled people, and more specifically those skills required to facilitate the labor integration of individuals with auditory disabilities. This process may take place in the workplace or in the place of address via television, computer and mobile phone.

The rest of the paper is structured as follows: section 2 presents the problem formalization, section 3 describes the developed technological platform and, finally, section 4 presents the preliminary results and the conclusions obtained.

2. PROBLEM FORMALIZATION

First of all we must define the group taken into consideration in this study. As indicated by Calvo Prieto [Prieto, 1999], the term auditory disabled refers to anyone who sees the word without sharpness enough or as indicated by the World Federation of the Deaf (Word Federation of the Deaf, EUD) person with hearing difficulty that can be alleviated with technical aids (FESORCV) [FESORC, 2001].

We understand as those for people with a degree of disability (now disabled) greater than 33% by deafness or hearing limitations that encounter communication barriers (Spanish Law 27/2007, of 23 October, recognizing the Spanish sign languages and regulates the means of support for oral communication of the deaf, hearing impaired and deaf/blind, 2007) [CNSE, 1998], or as a term currently used for the Confederation of Deaf People (CNSE) [FESORC, 2001] or the Spanish Confederation of Deaf Families. (FIAPAS, 2004) [FIAPAS, 2004]

To establish a proper design of professional guidance, we need to perform a detailed analysis of the specific characteristics of the position, profile and skills associated with their good work performance. Professional qualification is the "set of skills with significance in employment that can be acquired through training or other types of modular training, and through work experience" (Spanish Law 5/2002 on Qualifications and Vocational Training).

From a formal point of view, the qualification is the set of professional competencies (knowledge, skills, abilities, motivations) that allow us to perform occupations and jobs with a valuable labor market impact and that can be acquired through training or work experience.

It implies, as noted by Levy-Leboyer [Levy-Leboner, 1997] "a set of observable behaviors that are causally related to a good or excellent performance in a specific job and a specific organization" covering the full range of their knowledge and skills in personal, professional or academic, acquired in different ways and at all levels, from basic to top.

Our aim is not to find a professional qualification which corresponds to the Initial Professional Qualification Programmes (PCPI) but, based on the characteristics and requirements related to the position as identified in the Spanish Royal Decree 229/2008 of 1 February (BOE, No. 44 of February 20, 2008), the objective is to identify some actions, strategies and more appropriate training resources, technologically updated and valid for the training and evaluation of the disabled individuals. The formalization of the problem as relied on the Spanish Catalogue of Professional Qualifications and professional qualifications and an Auxiliary Operations and Administrative Services for the Family General Administration and Management Professional with Level 1 were selected.

From our point of view, it is essential to follow the determination of the legal requirements and current proposals in the employment context. This allows us to train competent workers taking into account the parameters required in our socio-labor context, as well as the parameters shared by any worker (with or without disabilities) to develop such activities.

We define, therefore, an employment and social integration strategy for people with different skills but that can afford with guarantees the demands of the position. Therefore, we respect the design of general competencies, skills units and professional achievements with performance criteria proposed in the Spanish National Catalogue of Professional Qualifications, as well as the different existing guidelines in Spain and those proposed by various international organizations.

Taking as starting point the document from the Spanish National Institute of Vocational Qualifications, it is defined a structure of the professional qualifications that will serve to design programs, resources, methodologies and educational interventions. In this sense, we have made a major effort to assign to each qualification a general competence. This competence includes the roles and functions of the position and defines the specific skills or competency units. It is described also the professional environment in which you can develop the skills, relevant productive sectors and occupations or jobs relevant to access it.

Furthermore, in a complementary manner, we analysed the professional achievements for each unit of competence along with their performance criteria.

The process started with the following situation:

- General competence is to distribute, reproduce and transmit the required information and documentation in the administrative and management task, internal and external, as well as to perform basic verification procedures on data and documents when senior technicians

require it. These tasks are carried out in accordance with the existing instructions or procedures.

- Competence units are able to o provide support for basic administrative operations, to transmit and receive operational information to external agents to the organization and, finally, to perform auxiliary operations for reproduction and archiving data on conventional computational support.
- Professional field: This individual operates as an employee in any company or private/public entity, mainly in offices or departments oriented to administrative or general services.
- Productive Sectors: it appears in all the productive sectors, as well as public administration. It is necessary to remark the high degree of inter-sectoriality.
- Relevant occupations and positions are office assistant, general services assistant, file assistant, mail classifier and/or message, ordinance, information assistant, telephonist and ticket clerk.

Table 2: Auxiliary Operations for Administrative and General Service professional qualification

<p>General competence:</p> <p>To distribute, reproduce and transmit the required information and documentation in the administrative and management task, internal and external, as well as to perform basic verification procedures on data and documents when senior technicians require it. These tasks are carried out in accordance with the existing instructions or procedures.</p>
<p>Competence units:</p> <p>To provide support for basic administrative operations.</p> <p>To transmit and receive operational information to external agents to the organization.</p> <p>To perform auxiliary operations for reproduction and archiving data on conventional computational support.</p>
<p>Professional field:</p> <p>This individual operates as an employee in any company or private/public entity, mainly in offices or departments oriented to administrative or general services.</p>
<p>Productive Sectors:</p> <p>It appears in all the productive sectors, as well as public administration. It is necessary to remark the high degree of inter-sectoriality.</p>
<p>Relevant occupations and positions.</p> <ul style="list-style-type: none"> • Office Assistant. • General services assistant. • File assistant. • Mail classifier and / or message. • Ordinance. • Information Assistant. • Telephonist. • Ticket clerk.

However, looking for a more specific training support, it is necessary to complete this information with the detailed description of the most common tasks that arise in professional performance. Thus, describing the specific tasks, we have established the type of support that this group of disabled people requires to carry out an effective performance of the assigned tasks.

Finally, we have established the most appropriate training strategies. Thus, we have described the most common tasks related to the professional profile and professional qualification presented in the previous table. The following example in Table 1 illustrates our proposal.

Table 2: Example of Competence Unit and Professional development

Competence Unit: To provide support for basic administrative operations.
Professional Development 1: To periodically register the Information updates of the organization, department, areas, personnel, according to the instructions previously received, with the aim of obtaining key Information to improve the existing services.
<ol style="list-style-type: none">1. Make a list of phone and fax references of the various members of the company.2. Update the directory of people.3. To register the physical location of people and areas within the company.4. To update the physical location of people and areas within the company.5. Safe-keeping of keys.6. Opening and closing the workplace and departments.7. Bring documentation to other centers in the city (unions, Delegation, City Council, County Council, etc.).8. Turn off and turn on the lights.9. Opening and closing windows.10. Open and lock any room.11. To register the inputs and outputs of the employees.12. To register a list for people who want to take the annual medical review.

3. TECHNOLOGICAL PLATFORM

Based on the problem formalized in section 2 we obtained a technological platform, shown in Figure 1, which is based on Cloud Computing paradigm and it is specifically designed to create intelligent environments [Weiser, 1991] oriented to facilitate the labor integration of people with auditory disabilities. From one side, the main objective of the Ambient Intelligence (AmI) is to achieve transparent and ubiquitous interaction of the user with the underlying technology [Weiser, 1991]. From

the other side, Cloud Computing is a model for enabling ubiquitous, convenient, on demand network access to a shared pool of configurable computing resources [Mell and Grance, 2011].

In this paper we use Aml to design a software technology specialized on determining the professional qualification, and providing on-line tools focused on transmitting signed orders that are easily accessed via mobile devices. Meanwhile, the platform is deployed in +Cloud [De la Prieta et al., 2013] [Heras et al., 2012], which is a cloud computing platform. This platform offers services as Platform as a Service (PaaS) and Software as a Service (SaaS) level. The project developed in this study is deployed at SaaS level and it uses for data storage the services provides by the platform at PaaS, concretely the service OSS (Object Service Storage) which makes use a non-relational database. And all educational resources are stored in the service FSS (File System Storage) provided by the platform.



Figure 1. Cloud-based platform

The functionality of the platform consists of a training web-based tool and a communication tool to send signed orders via mobile phone. Following it is described the main elements of the application:

Order signing. Once the competences to evaluate were identified, and the related professional developments were defined, we proceeded to signing the actions and tasks that can be performed by the disabled person. To make the signing we counted on the cooperation of the Federation of the Deaf of Castile and Leon, who have participated in the signing process. The process followed consisted on recording a series of videos in which the sign interpreters transmit specific orders for each of the actions to be carried out by the disabled person. The recording was done in blocks, taking into account the professional developments taken into consideration. Once the recording process finished, we proceeded to edit the videos obtained by separating each action individually and including subtitles in Spanish.

Web platform. In this task we obtained the design and development of a web platform that allows us to transmit work orders to the auditory disabled person using sign language format. The orders are transmitted via the Internet, television or mobile devices.

The appearance of the platform is simple, trying to facilitate the accessibility and usability. The navigation through menus and contents is easy and intuitive. All the pages have been designed with the same structure, trying to facilitate a familiar environment and similar interaction patterns independently of the page or section in the platform.

Figure 2 shows a web platform with different elements: a header, menus for Home, Signed learning, Learning evaluation and Contact:

- *Home.* It is the door to the web platform. It provides a user management section. A user authentication is required. Besides, this section describes the main objective of the platform and provides general instructions about its usability.
- *Signed learning,* provides instructions and exercises that are presented to the auditory disabled user by means of videos. The videos show a signing interpreter transmitting orders.
- *Learning evaluation.* In this section a series of series are presented to the user. The surveys allow us to evaluate the user satisfaction degree and the effectiveness of the learning process.
- *Contact.* It provides the contact details for the platform.

Once the user is in the learning section (see Figure 2), the learning process is started, displaying the videos for the different blocks of accomplishments that can occur in the office environment.



Figure 2. Learning section

Mobile application. In this work a mobile application had been developed for the platform that allows quick transmission of orders in the office workplace. The application includes voice recognition [Reynolds, 2002], so that a person at work may transmit voice instruction. These instructions will be

recognized by the mobile device, which accesses a remote server and display the video corresponding to the order in sign language.

The related work and the existing technologies were revised in order to choose the best option for the mobile module. An analysis was made of all mobile platforms on the market to see which is more suited to our requirements. The module was developed for iOS, and can be installed on a device like iPad iPhone, as long as it has the same operating system version iOS 5 or above. This module uses an XML file containing the structure of the data to be displayed. This XML file is stored in the cloud, and is parsed by our application. When the application starts, it parses the file and inserts into a table all the blocks, so that the user can choose one of them. Once the user clicks on a block, a screen containing an explicative video will be shown. The videos are also stored in the cloud. The advantages of using cloud storage are that the content can be updated very easily and without jeopardizing the proper functioning of the application. Below, in Figure 3, some screenshots for the developed application are presented, showing its operation.



Figure 3. Mobile application overview. Left: Main screen; Center: block scheme; Right: Block-detail.

And Finally, Figure 4 shows the playback screen, where the user is viewing a video. The application was initially developed for iPhone and iPad devices, but can be easily adapted to be executed on mobile devices.



Figure 4. Example of signed video

4. EXPERIMENTS AND CONCLUSIONS

The new model of labor relations established by the Spanish Royal Decree-Law 3/2012, of 10 February, on urgent measures for labor reform has among its objectives the promotion of inclusion in the labor market of more advantaged groups, including the people with disabilities. Our aim is to contribute to the goal of labor integration by means of a technological platform specifically designed to facilitate labor insertion in office environment of people with auditory impairment.

The developed cloud-based platform has a web interface and an interface for mobile devices, and is based on pre-recorded videos that contain instructions on actions to be performed by the disabled person in the office environment. The web interface was successfully tested in teaching through television, in collaboration with the company CSA (<http://www.csa.es/>) and the results have been promising. Moreover, the mobile application was tested in an office environment. Users and FAPSCyL specialists have highlighted the utility and advantages of the application. A test was designed with 10 basic tasks performed by 3 disabled people before and after the platform presented in this paper was installed.

In conclusion, the platform provided a new tool that contributed to increase the percentage of completed tasks up to 85%, when the initial percentage (without the platform) was 42%. The disabled users have remarked the ease of understanding of instructions they receive from their supervisors and ease of use of the system.

Acknowledgments This research has been supported by the project iHAS: Intelligent Social Computing for Human-Agent Societies. (TIN2012-36586-C03-03) funded by the Spanish Ministry of Science and Innovation.

REFERENCES

- [CNSE, 1998] CNSE (1998). Retos para el siglo XXI: Resoluciones del II Congreso de la Confederación de Sordos de España. Madrid: Confederación Nacional de Sordos de España.
- [De la Prieta et al., 2013] De la Prieta, F., Rodríguez, S., Bajo, J., & Corchado, J. M. (2013). A Multiagent System for Resource Distribution into a Cloud Computing Environment. *Advances on Practical Applications of Agents and Multi-Agent Systems*, 37-48.

[FESORC, 2001] FESORCV. Minguet, A. (Coord.) (2001). Rasgos sociológicos y culturales de las personas sordas: una aproximación a la situación del colectivo de Personas Sordas en la Comunidad Valenciana. Valencia: Federación de Personas Sordas de la Comunidad Valenciana (FESORD C.V.).

[FIAPAS, 2004] FIAPAS. Jáudenes (Coord.) (2004). Manual Básico de Formación Especializada sobre Discapacidad Auditiva. Madrid: Confederación Española de Padres y Amigos de los Sordos.

[Heras et al., 2012] Heras, S., De la Prieta, F., Julian, V., Rodríguez, S., Botti, V., Bajo, J. and Corchado, J.M. (2012). Agreement technologies and their use in cloud computing environments. Progress in Artificial Intelligence. Volume 1, Issue 4. 277-290.

[Levy-Leboner, 1997] Levy-Leboner, C. (1997). Gestión de competencias. Gestión 2000. Barcelona.

[Mell and Grance, 2011] Mell, P. and Grance, T. (2011). The NIST definition of Cloud Computing. In: NIST Special Publication 800-145.

[Reynolds, 2002] Reynolds, D. A. (2001). An overview of automatic speaker recognition technology. Proceedings of 2002 IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP 2002), vol. 4, pp. 4072-4075.

[Prieto, 1999] Prieto, J. C. C. (1999). *La sordera: un enfoque socio-familiar: reflexiones a partir de una monografía*. Amarú.

[Weiser, 1991] Weiser, M. (1991). The computer for the 21st century. Scientific American, 265, 3, 94-104.