Abstract: The access to education and the new technologies for the persons with disabilities is the main objective of the action plans initiated in the EU but also in Romania. The accessibility of information for visual impaired persons must be seen both in terms of access to educational objects and access to general information available on various sites, using the voice recognition assistive technology and speech synthesis in Romanian. The paper’s aim is the presentation of options for the information accessibility to the blind persons and proposes a way to integrate assistive modules into e-learning platform.

Key-words: Accessibility, Vocal synthesizers, Assistive technologies, Web service, Computer assisted learning, W3C

1 Introduction
At basis of many tools accessible to blind persons there are speech synthesis systems which produce voice signals starting from a text [1]. The synthesis involves various constraints: the vocabulary is virtually unlimited, and the short or long sentences handed, must show a natural character. Moreover, the synthesis must comply with normal intonation possible to ensure good intelligibility. As you can't save all possible phrases appropriate you must choose a finite and reasonably limited set of basic linguistic units, which, through concatenation to allow synthesis based on some text.

Web services can facilitate communication between different applications. There are many types of integration but most interesting is the composition of Web services. Web services are useful in implementing e-learning systems interoperability. The building of applications is based on reusable components, whose functionality is maintained by Web service providers and easing of communication is given by the fact that Web services communicate through an HTTP channel [6]. At present, the XML-based Web services are the fastest mechanism for integration.

2 Solutions for information accessibility to the blind persons
The content accessibility standards developed by W3C (World Wide Web Consortium) promote the development and interoperability of the Web and especially its universality.

An application for accessibility of Web pages is usually a client-server application that can provide access to the page, using the synthesized voice. This can be useful blind persons, but is especially appreciated by people with amblyopia (who don't use a screen reader) or for dyslexic people (who even see, but can't read), and by people with cognitive disabilities.

For this category of users designing an application is closely linked to respect accessibility standards and using of assistive technologies, in this case speech synthesis and voice recognition for the Romanian language, with MBROLA and IVONA voice synthesizers [8].

2.1 The access to educational objects
In the computer-assisted instruction, the access to educational objects must be addressed in terms of developing applications for reading information from different files (Fig.1). Using the sound interface, the user will be guided towards information containers, and by choosing the desired file name and its extension there is a verification of the existence of resources followed by their acquisition and sound rendering, with the possibility of printing in Braille format.

![Fig.1 Accessing files](image-url)
If the blind person wants to enter a filename, he will hear the keys pressed so that finally to hear the full name of the file (possible by using control Preprocesare_Control).

The option sound on character typed is possible by implementing a new class called TextBoxAudio derived from TextBox class.

Using Word and Excel files type in applications requires the addition of references needed moving them. The process is called interoperability, i.e. the ability of the disparate systems to communicate and access to not scattered information. Interoperability is achieved through services provided by Microsoft.NET Framework for interacting with COM components, COM + services, external libraries. It provides access to existing COM components, without requiring modification of the original component. Incorporation the COM components will be made through specific instruments that can be used immediately after being imported.

The process of transforming text into sound using MBROLA includes the following steps [1]:

a) Connection to database with phonemes and waves, with two steps:
   - Connect to the database where phonemes are retrieved from the specific graphemes.
   - Call dictionary of Romanian language phonemes "ro1", provided by MBROLA synthesizer and charged in synthesizer with init_MBR() function.

b) Preprocessing, is the stage in which takes place the transcript of text with the aid of the phonemes and use the transformation algorithm in transcript numbers in words. Thus, preprocessing may be: simple (text only), preprocessing numbers (integers and real by dialing preprocesare_numere() function, preprocessing of complex text (preprocessing of text and figures).

c) Transpose text file in .pho type file by assigning for each of phonemes a series of values which represents the voice fundamental frequency (pitch). The file .pho type will be read by MBROLA.

d) Audio file generated is done by use of the mbrola.dll library. Loading ro1 the dictionary diphones in the synthesizer with init_MBR function (). The string of phonemes is then ready to be processed by MBROLA synthesizer using write_MBR function (). Reading is done from synthesizer to memory using read_MBR() function. By this function is read the processing phonemes result from the buffer of synthesizer. With reset_MBR() takes place the synthesizer’s resetting.

For application flexibility and portability, are built controls (WindowsControl Library):

- Preprocesare_Control.dll - encompasses the entire phase of transformation and establishment of sound;
- TextBoxAudio.dll - inherited from the TextBox control, this control provides sound reproduction facility of each character typed;
- Print_Control.dll - allows preview and print out the text you want in a Braille font, XBraille E. JALLY specific to people with vision problems.

The first step in manipulating Word documents in .Net is adding a COM reference Microsoft Word 11.0 Object Library. Is added: using Microsoft.Office.Interop.Word; After instantiation word processing (Word.ApplicationClass oWordApp = new Word.ApplicationClass ();) can be called specific methods and properties of Microsoft Word. Adding a COM reference is made to handle Excel files in .Net. The files of .txt type don't require reference or adding any instantiation of the application in basic application.

Text synthesized by MBROLA can be listened also with IVONA, considered one of the best synthesizers in the field for Romanian language. To use synthesizer IVONA, is necessary to add the option that facilitates user access to files, so that in passing the mouse over an element of the list, the user will hear the file name and can have access to it via sound rendering.

2.2 The access to general information available on different sites

The accessibility information to sites requires the development of APIs (Application Programming Interface) to intercept information from a Web browser control and facilities for audio presentation of information.

To intercept the information in the browser and their translation into audible language are used web services, which can facilitate communication between different applications. Also they permit their reuse and create new opportunities in many areas as they provide an easy way to distribute information to a large number of consumers.

The request (message) is sent to server on which there is the web service. The server will process this request, will forward it to the web service, which will execute the method called and will return the response to server, which in turn will send it toward the application. Calling web service within an application built in C # is done by adding a Web reference to webservicex.net service. It then declares objects of predefined classes in service (for example, an object of type Global Weather), then you can call the associated methods. Using other web services (exchange rate, search, e-mail) is performed similarly, by adding the reference, the declaration of variables and calling functions provided by tools accessed in order to return the desired result.

For the synthesized speech control are used control tags which check the volume control, frequency or breaks that might occur in synthesized language. Thus, after entering text in the textbox, the user can choose to render synthesized speech including pauses between words or the rendering to be faster.
Other options can be: for e-mail, where the opening of window and adding the necessary elements is assisted by audio messages released when the user passes the mouse over a particular field, option which allows the simulation Google search engine, with web service provided by it. Google API services have the following classes: GoogleSearchService, ResultElement, DirectoryCategory and GoogleSearchResult. When the mouse passes over the textbox in which follow to be entered keywords for search, the user will hear a message to indicate this and to induce him to perform a mouse click to reach that area. After entering keywords, the user can select the search option and the content of the first link to load the page using a web browser. Persons with visual disabilities can listen to the content of the first page found, the search is accomplished pages only in Romanian.

The application as web browser is useful for people with severe visual disabilities, impaired lower view, but also people with motor or learning disabilities. Application accessibility consists in the possibility of taking over the voice commands, and auditory rendering of the content of web pages.

The composing of services provides the access to information services for blind persons (weather, exchange rate, media), documentation service (web browser adapted) or communication (reading email, chat, so).

Using the web browser by the persons who can't see is now possible because they are "announced" at any time on which option in browser is located the mouse. Some actions can be triggered with voice commands, such as navigation: back, forward, stop, refresh. The user receives auditory feedback when takes place the onset of action (the command is carried out) and to the finish of actions: loading web page, sending an email.

For options in the browser are determined voice commands, as predefined key combinations, that can be called by the user. When loading a Web page the browser will not read the entire contents of the web page, but will read the title page loaded followed by the number of existing images, the number of links, the buttons and paragraphs. Then can be read to select specific elements on the page (links, images, buttons, the paragraph with a number, the selected text or all text).

New Microsoft technologies make it possible the applications development easier using speech recognition and voice synthesis when using SAPI interface.

Also, Windows Vista has additional features compared to Windows XP, namely the speech recognition engine installed with the operating system and an enhanced SAPI interface (version 5.3).

Despite the emergence of a performance synthetic voice for Romanian, currently there isn't speech recognition engine for the Romanian language, therefore the commands in the Romanian language are hard to recognize.

2.2 The access to printed information

Another application of access technologies is an optical character recognition software (Optical Character Recognizer, OCR), which converts the scanned images of pages from a book in text files that can be read using the voice synthesizer or a Braille display (Fig. 2). This application allows the blind persons to read a book, a magazine or a newspaper.

![Fig.2 A system architecture for Vocal Rendering of Printed Documents [4]](image1)

To implement a system for rendering of documents emphasis should be on the development of capable interfaces to connect specialized components developed by software firms [7].

3 Proposal for integrating assistive modules in an open source learning platform

Learning objects are closely related to e-learning standards, therefore to be transported, the object must meet certain standards and to be reused must have a specific instructional design. Educational objects as educational components are stored and accessed independently, and using the reassembly are created new courses or individual learning sequences. Each learning object is characterized by a set of attributes that enable tracking, the management and its evaluation. The descriptors collections that uniquely identify and complete an educational object represent metadata, which are based standards. Metadata allow obtaining information from another computer on the structure, content and use of educational material [2].

The existence of a consensus on metadata schemes for learning objects shouldn't be an obstacle for digital content developers.

In Web context there are two possibilities for implementation of metadata: XML (Extensible Markup Language) as data modeling language and RDF format (Resource Description Framework) metadata modeling language [3].
Scheme for access to a learning platform with facilities for the blind persons may be (Fig. 3):

![Diagram of a learning platform with facilities for the blind persons]

Fig.3 Scheme for access to a learning platform with facilities for the blind persons

Such a platform can integrate mechanisms for acquiring of more complex knowledge, like mathematical expressions compound, which requiring using previously a software module for textual transposition of equations.

The access to learning platform can be done using:
- Microsoft. NET Framework Version 3.5, which provides facilities for stability, ease of development and use, availability of long-term support for a wide range of applications, rapid result, modernity and interoperability.
- To memorize encodings SAMPA (Speech Assessment Methods Phonetic Alphabet) characters associated text, but also to retain the dictionary of synonyms, is used a database.
- The database, can be created with Microsoft Office Access 2007 or MySQL, and the connection to it can use MyODBC specific objects.
- Additional packages such as the function libraries (DLL), the sounds, the images or fonts used by applications which are included in the kit installation or in application.
- Audio programs running on Microsoft Windows XP SP2 Professional or Vista to create the .wav and .txt files.
- Programs for printing and post-processing.

The synthesizer, built on MBROLA library basis, generates an artificial language using concatenation diphones from Romanian dictionary language, and imposes integrity restrictions, while the synthesizer IVONA is based on unit selection technique.

4 Conclusions
The scientific concerns of building IT systems for people with visual impairments are encouraged by existing law and numerous treaties signed in the European Union, treaties whose aim is to increase accessibility of IT applications.

New technologies offer a perspective to create educational content and its transmission and access. For the computer-assisted learning the designing of web sites and web applications must be centered on user.

The researching, in this case, is based on the synthetic rendering of information displayed on the current web site and taking voice commands to direct navigation. The need to create accessible websites that integrate Web applications with educational content is an option for the computer-assisted learning based on the Web. Such is provided the access to information, as well as the training of persons with visual disabilities.

References: