

Ukrainian team

Version 0.3 (Release Candidate)

Fenestra

“Education through integration”



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Contents

Introduction	- 2 -
The Problem	- 2 -
Fenestra’s solution	- 2 -
Two types of interfaces: Graphic User Interface and Voice User Interface	- 2 -
Interaction with the program using Fingertips reader	- 3 -
Web browser for people with visual disabilities	- 4 -
Distant lessons and tests	- 4 -
Fenestra Risk Game	- 5 -
Fenestra Board	- 5 -
System’s architecture	- 5 -
“Fenestra” client design	- 6 -
Conclusion	- 6 -

Introduction

The goal of “Fenestra” project is to enable better education for people with visual disabilities. The slogan of “Fenestra” project is “Education through integration” which means that the software provides necessary tools to integrate visually disabled people into the educational process together with ordinary people. Our “ideal world” is the world where modern technologies enables people with visual disabilities to study together and on equal terms with normally sighted people.

The Problem

During frequent consultations of development team with representatives of the target audience, “Vikno v svit” organization, the following main problems were singled out:

- Modern interfaces are packed with graphics and animation content (especially web pages) that makes them almost useless for visually disabled people
- Special devices for such users are too expensive
- Special organizations, which were created to help people with visual disabilities, unintentionally isolate such people from others, which creates severe social problem for them

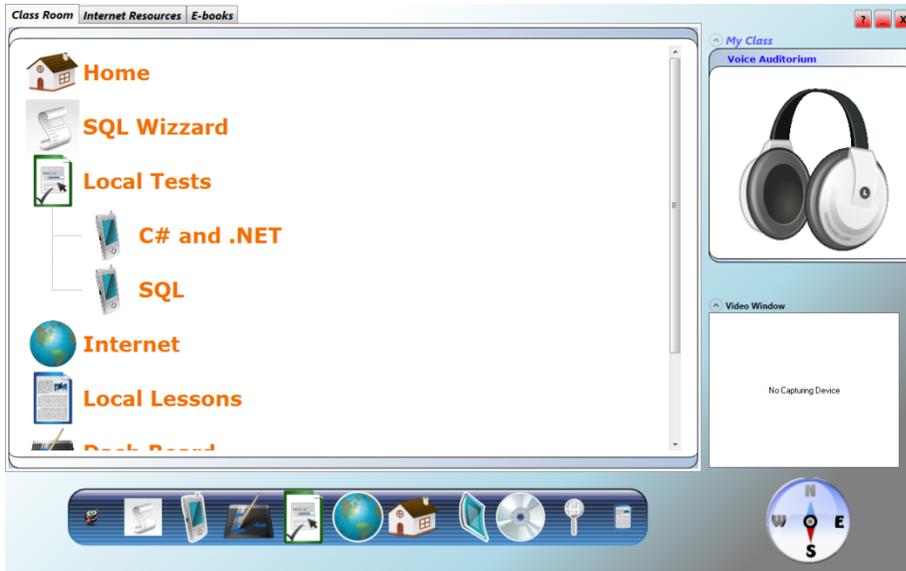
Presently on the market there are a lot of software for people with visual disabilities, however it has some severe shortcomings which we tried to get rid of in our software. First, there are a lot of so called “screen readers” which insonate user interface of the usual programs by reading their menus, buttons and so on. This approach is universal, but it does nothing with pictures and is a very inconvenient one for software with complex user interfaces. Also, such programs usually do not provide any alternatives for input. Another type of software for visually disabled people is the one that supports special devices providing Braille input and (or) output. However, these solutions are usually very expensive and not all people with visual disabilities know Braille alphabet.

Fenestra’s solution

Two types of interfaces: Graphic User Interface and Voice User Interface

To enable real integration of visually disabled people into the educational process together with ordinary people “Fenestra” has two types of interfaces:

1. Graphic User Interface, built using Windows Presentation Foundation
2. Voice User Interface, built using Microsoft SAPI



Depending on the user's needs "Fenestra" can work in two modes: normal and special. While in normal mode the usual user will be able to use "Fenestra" graphic user interface, in special mode he/she will be able to use "Fenestra" voice user interface. "Fenestra" voice user interface is fully controllable by the

user i.e. the user can control it by going to the next or previously pronounced phrase manually. Except of voice synthesis, "Fenestra" supports voice recognition to enable interaction with the system using voice commands.

Interaction with the program using Fingertips reader

To solve the problem of user input into the program "Fenestra" uses Fingertips readers. It is possible to connect one or two fingertips readers simultaneously for better user experience.

The idea of using fingertips reader for user input by people with visual disabilities is very simple and efficient. Since each human being has unique fingertips on each finger, it allows a wide range of possibilities for interacting with the program. In the case of visually disabled people it is even more convenient since such people are used to perceiving tactile information.



To start using this type of input the user must register his fingertips in the system. User's fingertips are stored on the local machine only in encrypted format. After registering his/her fingertips the user can logon into the system just by pressing any of his/her fingers to the fingertips reader.

While working with the program in the special mode the user can control the program and enter data into the program by pressing different fingers to the fingertips reader. The system will instantly recognize what finger was used and perform required action depending on the context of the program. An instant reaction of the system is provided by the fact that it is enough for the matching score to be equal to 20% for distinguishing between fingers while the matching score of at least 90% is required to identify a person for security reasons. This fact except of excellent matching speed makes it impossible to use fingertips stored by the system for security reasons by other people. A popular Griaule GrFinger4.1FREE SDK was used for programming logic of interaction using fingertips reader. The system has been successfully

tested with Microsoft Fingertips Reader and the majority of other popular Fingertips readers are supported by the system.

Web browser for people with visual disabilities

It is not a secret that the Internet is a very important source of educational information. Therefore Fenestra has a special browser for visually disabled people. It can work with ordinary and adapted web pages. In the case of a non adapted page it parses HTML content of the page and tries it's best to insonate it. However it becomes really efficient in the case of adapted web page. It is not necessary for the webmaster to change its source for the page to become adapted. A template should be created for the page in xml format using regular expressions. The rules for creating these templates are very simple and flexible. To create a template for web page one must: identify what content of web page must be read and in what sequence, identify what parts of content are the subparts of previous content, create regular expressions for this content. Since HTML code contains a lot of tags and characters which are not shown to the user, it is really easy to uniquely identify any part of content by simple regular expression. The following example is an example suitable for any Wikipedia article and allows to read the content of the article.

```
<PageParameter>
  <Name>Contents</Name> - the name of parameter, will be pronounced by "Fenestra" blind browser
  <Text /> - Inner HTML of parameter, this must be left blank and is filled by "Fenestra" blind browser automatically
  <RegularExpression><table[\s]*id="toc"[\s]*class="toc"[\s]*summary="Contents">[\D\d]*?</table></RegularExpression>
the regular expression for this parameter
  <Link /> - the link, in the case if this item represents an active item (i.e. some form, link, etc.)
  <SearchInParameterName /> - the name of a parameter, in which to look for this item; leave blank if it is BODY
  <UpperParameterName /> - the name of a parameter, which is logically the parent of this item (i.e. "Contents" is upper for
"Contents Item")
  <NeedsRepair>>false</NeedsRepair> - true if the <Text /> can contain non-alpha or non-numeric symbols
  <IsMenuOrContents>>true</IsMenuOrContents> - is this a menu ?
  <IsMenuOrContentsItem>>false</IsMenuOrContentsItem> is this a menu item ?
</PageParameter>
```

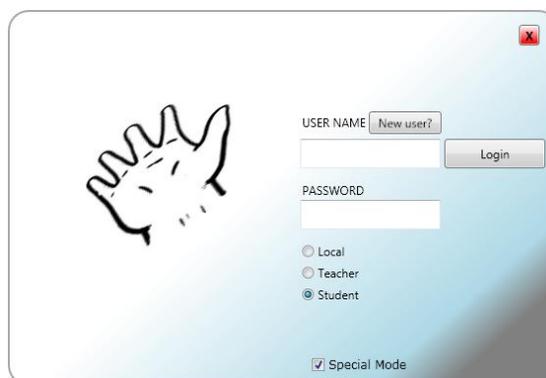
The combination of such parameters in one XML file will allow very convenient page insonation by the "Fenestra" web browser.

Distant lessons and tests

For the convenience of both types of it's users "Fenestra" supports conducting distant lessons and tests. Using this feature the teacher and class members can be distributed geographically anywhere in the world and participate in the class simultaneously.

"Fenestra" can be run in three different modes, depending on the role of it's user:

- 1) Teacher
- 2) Student
- 3) Local



In the Teacher mode, “Fenestra” can control, using .NET remoting, what is happening on the computers of logged on students. For example, the teacher can switch slides of presentation, show any other form of learning material, run tests and see their results.

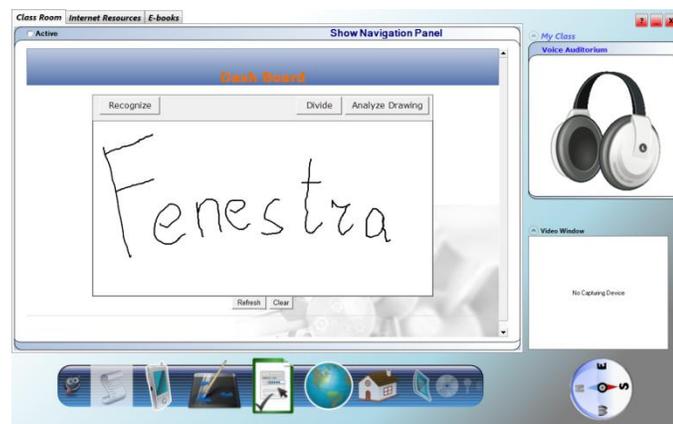
“Fenestra” also has reach communication features. It allows audio and video transmission between teacher and students.

Fenestra Risk Game

“Fenestra Risk” is an educational game included in “Fenestra”. The players of the game can either see or hear the map. If a player clicks somewhere on the map, he/she will be asked some question about the geographical location, where he clicked. If his answer is correct, the player earns scores and can ask other players his own questions. This game uses web service and supports all of the “Fenestra” accessibility features for players with visual disabilities. This game can be played by both ordinary people and visually disabled people simultaneously.

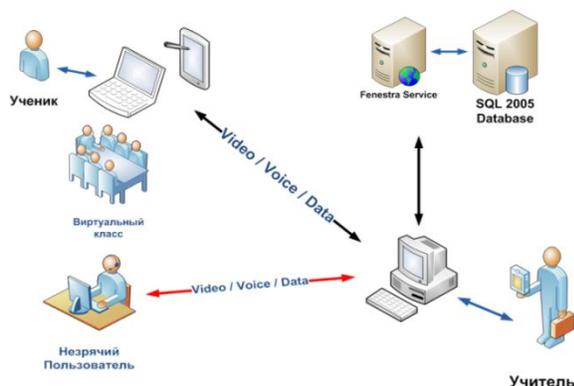
Fenestra Board

Since any classroom has a blackboard, “Fenestra” includes a virtual blackboard. Any student and teacher can draw anything on the blackboard directly from his “Fenestra” client. The drawings from all logged on student clients are collected by the teacher’s application, combined and shown to all class as one whole picture.



For people with visual disabilities, “Fenestra” board includes handwriting recognition features, implemented by means of Microsoft Ink SDK. Combined with speech synthesis, these features allow visually disabled people to hear what is written on the board by other students. It can also recognize simple geometrical shapes such as a square, an ellipse, a triangle, etc.

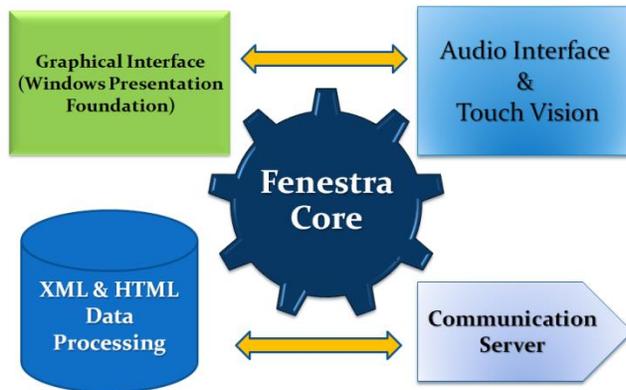
System’s architecture



The “Fenestra” client application is designed for .NET 3.0 Framework and Windows Vista. It can be run on a laptop, tablet pc or ordinary desktop. Fingertips readers are recommended for using in special mode. There are “Fenestra” web service and SQL Server 2005 databases in the Internet which are responsible for storing and processing data.

“Fenestra” client can interact both as a teacher and student application. Clients in special and normal modes can participate in one class simultaneously. Voice and Audio transmissions are conducted directly between the teacher’s and student’s machines.

“Fenestra” client design



- GUI – is based on Windows Presentation Foundation
- Audio Interface & Touch Vision – works in special mode, for people with visual disabilities. Uses Speech recognition/synthesis and Fingertips readers.
- Fenestra Core – core functionality responsible for user profiles, lessons and tests representation and so on.
- XML & HTML data processing – processes XML and HTML data for better insonation (Web browser)
- Communication server – responsible for audio and video transmission

Conclusion

“Fenestra” is a complex educational software which helps people with visual disabilities study together and on equal terms with people without eye dysfunctions. It has all set of features required from modern educational software and may be very useful for normally sighted people.

However, apart from the features, that are standard for any educational software it also includes a unique set of accessibility features aimed to help people with visual disabilities. These features are:

- ✓ Interaction with the program using fingertips reader (1 or 2 for better experience)
- ✓ Fully controllable voice interface: voice synthesis and recognition
- ✓ Special browser for visually disabled people which can use websites XML templates to create more convenient insonation of web pages
- ✓ Special game, Fenestra Risk, which can be played by both people with visual disabilities and normally sighted people simultaneously.
- ✓ Handwriting recognition

The goal of “Fenestra” is to integrate people with visual disabilities into the educational process together with normally sighted people, which will help them to feel functionally equal to ordinary people.