

ARTIFICIAL INTELLIGENCE SIMULATION PLATFORM

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ABSTRACT

A University Development Foundation (FRVŠ) project dealing with artificial intelligence branch tuition subjects was solved at the Department of Controls and Instrumentation, BUT. It resulted in creation of a software tool, a simulation platform, usable for tuition support of both under-graduate and post-graduate courses. This paper briefly describes the tool, its main functionalities and structure.

1. INTRODUCTION

The goal of the project was to create a study development environment with a set of embedded tools that enable the students to solve many interactively and practically focused tuition tasks as well as to conduct their individual research. The outcome of the project is a software platform that helps the students penetrate deeper into the gone over problems (in a, from the user's point of view, standard way) during their lesson attendance and give them a possibility to freely experiment and develop their own project while studying individually. That is with a minimum effort put to getting used to the tool itself.

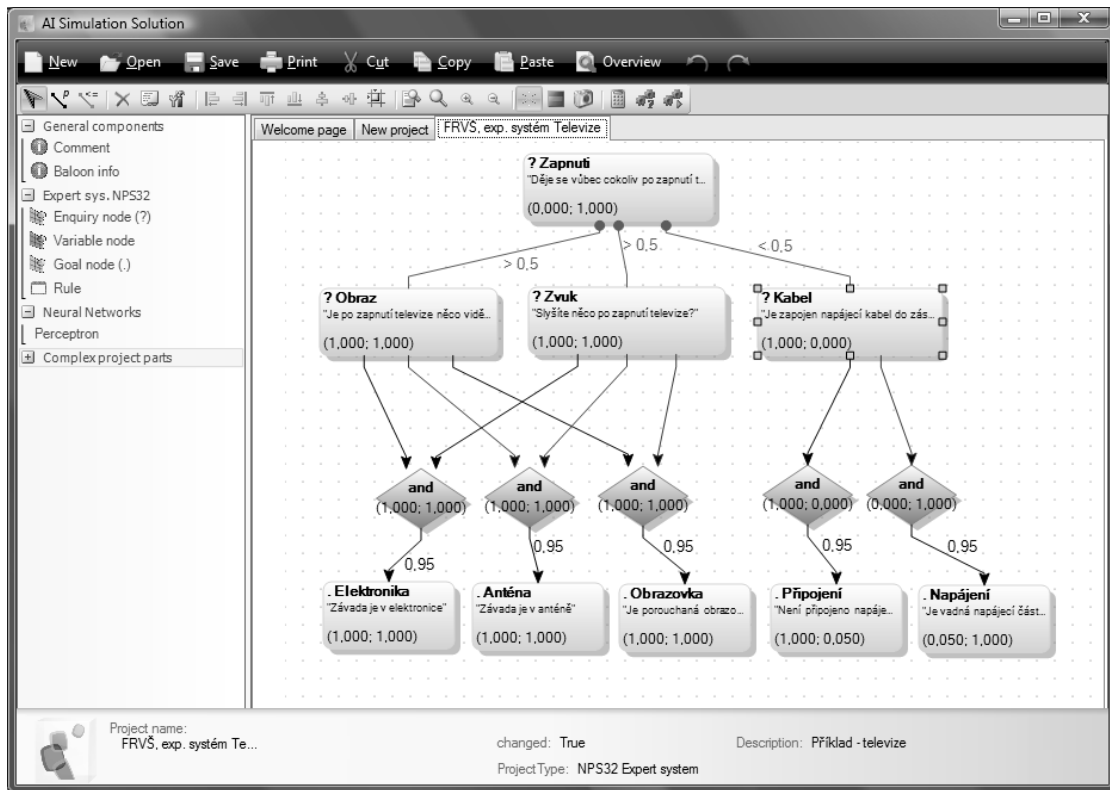
The platform uses the great potential of visualization letting the user work in a CAD-like way (common to any artificial intelligence project type currently available for the platform), as shown in Fig. 1, rather than having to use script-languages or outdated software tools specific to individual fields of interest. It benefits greatly from its standard yet opened core that may be modified should any new requirements arise (.NET, which is used, also allows for downloading and incorporating of numerous third-party tools, many of which are available as opensource or free add-ons).

2. SIMULATION PLATFORM

2.1. DEVELOPMENT PROCESS

Prior to starting the work itself, the authors have compared available competing solutions in order to select the most suitable one that should be used as a foundation for this project

that could be extended, modified or used as a programming tool. Tab 1. show three considered solutions with their most important pros and cons.



Obrázek 1: Application screen, expert system tool

Platform	Assets + and Drawbacks –
MATLAB	<ul style="list-style-type: none"> + neural network support readily made – financially demanding – low performance of m-scripts – GUI creation complicated / limited – version & installation carry-over problems
Statistica 8	<ul style="list-style-type: none"> + easy data manipulation – students' licences unavailable – non-application oriented (specific API knowledge reqd.)
.NET Framework C#	<ul style="list-style-type: none"> + academic licence available + common knowledge of C + sufficient performance even in graphics + openness, universality + existence of 3rd party add-ons

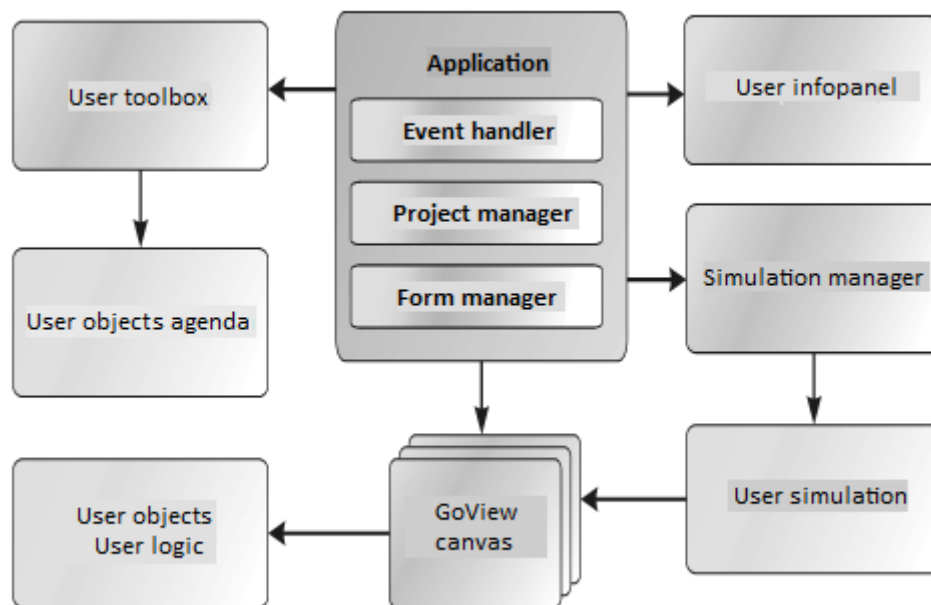
Tabulka 1: Comparison of possible project foundations

Especially for its universality and comprehensibility to students, C# and .NET were selected for further work.

2.2. CRE – COMMON RUNTIME ENVIRONMENT

CRE is a common application base built on MS .NET Framework 3.5. Its basic structure can be seen in Fig. 2. The CRE blocks take care of common application functions and when following .NET development guidelines one can use these to easily extend the AI simulation platform for any purpose wanted. Among the functions provided by CRE are:

- saving/opening projects (uses serialization for operation on XML format),
- undo/redo,
- visual environment (toolbox, drawing canvas, printing, clipboard operations),
- Vista-feel (infopanel, planned is 2007-styled ribbon),
- object property view,
- user project and in-project user objects event parsing and handling,
- simplified multithread computing for project processing and simulation



Obrázek 2: AI simulation platform CRE

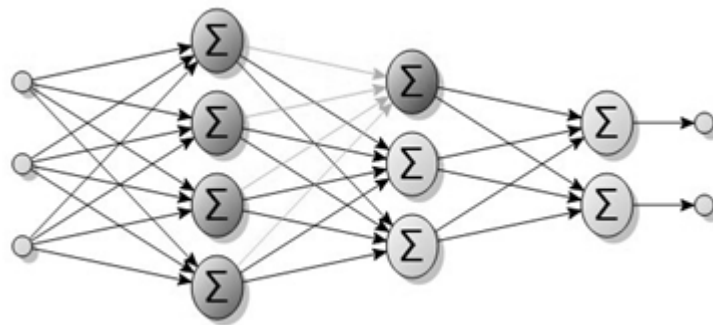
Currently, AI simulation platform includes two tuition-support and simulation tools, one dealing with neural networks, the other dealing with expert systems – namely NPS32. It also features what is called a *complex project*. A complex project can encapsulate several sub-projects of different types that act as stand-alone computation parts linked together via their input/output ports feeding processed data through the simulation chain as required. The simulation behaviour can be controlled by incorporating user input fields and dialogues, if/switch statements etc. All that is programmed on platform's visual canvas.

Currently, more features are under development:

- input extension (technology connection, standard bus datapoints readings – KNX, RS232, ...)
- fuzzy systems project type

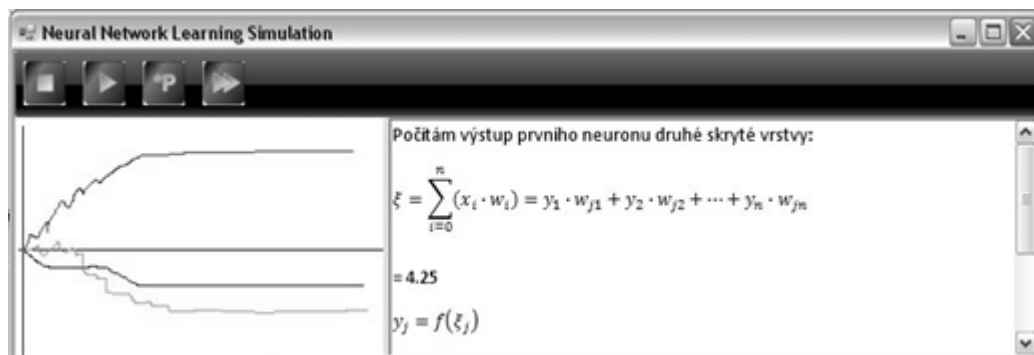
2.3. NEURAL NETWORKS TOOL

This is a modular tool designed for work on selected types of neural networks (currently multilayered perceptron, backpropagation algorithm) that allows for free topology design (Fig. 3 shows an example neural net designed in this tool). It makes it possible to access to network nodes' properties during the adaptation phase thus demonstrating neural network behaviour.



Obrázek 3: AI simulation platform neural network tool – topology design

Planned is an extension capable of importing and converting graphical data into groups of training patterns. Fig. 4 has a snapshot of training process simulation form.



Obrázek 4: AI simulation platform neural network tool – NN training

2.4. EXPERT SYSTEMS TOOL

The focus here, again, is put on visual representation of the inner structure of an expert system knowledge base (as show in Fig. 1), replacing an old-fashioned text oriented non-coloured script used in classes until the moment. The student / researcher is allowed to changed the properties of individual knowledge base components. The tool then automatically recomputes all relevant values of all coinciding nodes thus enabling the student to see the effect of the changes made immediately without a need for trial-and-error approach.

During the expert consultation simulation it shows all relevant mathematical apparatus used with current variable values filled in. That again speeds up the tuition process and greatly eases up the development of any individual projects.

3. CONCLUSION

An artificial intelligence development platform currently being deployed for expert systems and special types of neural networks tuition has been developed. It replaces outdated tools easing the study process for students of artificial intelligence branch. Its programme model makes it a suitable tool for individual research of both under- and postgraduate students with the possibility of employing any modifications needed with just the basic knowledge of .NET/C# coding.

More detailed information can be found in the project's closing report [5] and therein listed references.

ACKNOWLEDGEMENT

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