Using a 3D Animated, Natural Speech, Logic-Based Agent as a School’s Web site guide and course advisor

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Abstract—The use of web sites in University schools around the world has become more important than ever. Functionality has grown beyond simple presence on the web: students use them to check course schedules, enrollment, payment and several other administrative and learning activities. Because of this reason, the interaction and communication between these web sites and its users must be pleasant, useful, efficient and dynamic, considering the high volume of information that they usually contain. This paper proposes the use of an animated character (agent) which serves as a web site host and establishes communication with the user through a series of questions and answers using natural language through a text box. The user receives the agent’s answer in text and audio (voice) also in natural language (spanish and english versions are available).

This agent serves as a course advisor for the student [5], suggesting courses to enroll and answering questions about them. The agent can also guide users through the web site [8], allowing them to access specific parts of the site faster since web pages are loaded by the agent considering the information asked. This guidance is accomplished by analyzing the data generated by the questions and answers between the agent and the user using Amzi Prolog.

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1. Introduction

Currently, few web sites have an animated intelligent agent serving as a web guide and course advisory for students.

When these animated characters are used in web pages, most of them tend to serve for a specific purpose (teach a particular area of a subject, for example) and usually lack the feature of intelligence: the ability to learn. In addition to that, an animated, logic-based, intelligent agent allows the users to interact with it and keep their preferences about the site and web pages visited Fig.4. This paper develops a proposal for a Web Design Environment in which users interact with a human look web guide and advisor using natural language communication.

The agent serves as the web site’s host (see Fig.1) and establishes communication with the user by a series of questions and answers using the natural language through a text box. The user then receives the agent’s answer in text and audio (voice) [2]. The agent also serves as a source of information for the user (avatar) and as a guide through the web site, allowing the avatar to access specific parts of the site in a direct and therefore faster way because the agent is constantly loading the web page with the desired (asked) information. This guidance is accomplished through analyzing the data generated by the questions and answers between the agent and the avatar. The students can ask to the agent for advice regarding which course to enroll and its requirements (for example, course dependency: previous courses completion in order to enroll the new one).

At the Autonomous University of San Luis Potosí (U.A.S.L.P.), we are working on a university’s web site project to help students and people in general Fig.1. In order to add dynamism to the web site, an animated intelligent agent is used as a guide of the web site and as students’ consultant. This agent works as a host of the site and establishes communication with the user through a series of questions and answers expressed in natural language. The user can make a question by typing it in an input text box, the agent processes the question, and the user will get the agent’s answer in both text and audio (voice). At the same time, the agent seeks and loads the web page that may contain the information requested by the user using the already made questions. The agent learns about likes and preferences of the user, allowing him to customize the web site and to achieve a more friendly interaction with the user.

2. Intelligent Tutoring Systems (ITS)

We considered the classic structure of the intelligent tutoring systems [6] as a starting point. The basic components
and interfaces of each of the modules were redefined, some modules were added to satisfy the needs of both, students and professors, in order to perform the teaching task in an effective way. Many efforts have been taken towards the separation of the three fundamental modules of the intelligent tutoring systems, but subsequent implementations have shown that the domain can not be separated completely from the tutor and student modules. The first step was to necessary analyze the interaction of the modules for a general and hypothetical domain, and then do all the necessary modifications for this particular domain. An intelligent tutor system behaves as a professor (instructional systems), controlling the work flow, and leading the interaction with the student. On the other hand, intelligent advisor systems with 3D animated agent are oriented to help the student through its learning, making suggestions regarding the subject and helping the student to improve his performance (it behaves as a tutor). The student leads the work and the interaction, performing in the order which he considers the most convenient. The modules can be basically defined as:

2.1 Student Model

In this model, the individual characteristics of the student must be modeled. One of the most important is the instant individual knowledge regarding a domain. The model of the student have to reflect how much he knows about a domain, as well as its cognitive experiences of learning. From these a diagnostic can be made. Consider that this model will have to be able to interact with its pair, which is a fundamental characteristic of intelligent advisors.

2.2 Pedagogical Expertise Model

This model has the knowledge about the teaching strategies and tactics and must have the ability to choose which one to use, considering the characteristics of the student (those stored in the student’s model). The expert model or domain model talks about in detail about the subject or course material to be learned.

2.3 Domain Expertise

This module has the knowledge about the subject formed by the production rules, stereotypes, etc. From this module, the tutor can obtain the knowledge for teaching. In our experience, the best intelligent systems ever developed, its Domain Expertise module, use an Expert System.

2.4 Interface

This is related to the way the ITS and the real student interact. Its function is to present the domain’s material and any other didactical material in a proper way. In our developed system, we achieved the best interaction with the students when we used a 3d animated agent in the web site. The 3D animated agent allows the users to interact with the system. Three specific types of users can be distinguished: the Student, the Instructor and the Developer of the Web System.

2.5 Instructor’s Model

It performs a general evaluation of the system and creates the necessary feedback for the instructor. Must be pointed out that intelligent advisors do not replace a human teacher, rather act as a complement, therefore this module should give to the instructor any information that may help him to modify the teaching methods used with the students during classes.

2.6 Interaction Between Fundamental Models

Figure 2 shows the five fundamental models and the way they interact with each other for any given domain. This approach separates for completely the interface with the 3D animated agent from the classic modules used in an intelligent tutoring system. Interactions happen in the following way: A web request is performed from the user over the web site clicking a link or writing something in a messages box. The 3D animated agent is always waiting for some event to happen so he gives an answer making a search in a Prolog’s Database and returning the result of question (a query) in a new ASP web page. The speech to say is received by the agent from the same Prolog’s Database (it has natural language rules) see Figure

![Fig. 2: Models and Interface using 3D Animated Agents](image)

Intelligent Animated Logic-Based Agents Logic-Based agents have the same features as non logic-based agents: they are autonomous, graphically embodied in a virtual environment, are able to interact intelligently with human users and other agents, and their environment but the engine for making decisions is different see Fig.3. An autonomous agent makes decisions using a deduction engine based in a
first order logic.

The formal logical elements are:

L : set of statements first logic order.
D= p(L) : set of L data base.
Inner state of the agent: it is an element of D.
D1, D2: members of D.
r: deduction rules set which agent use in the decision process.
The principal tasks to do are:
1.- Host in a web site.
2.- Assessing changes class courses and academic activities.
3.- Move around the site and load new pages.
4.- Detecting all events generated for the users (click at the link, tape something, etc...).
5.- The communication with Amzi Prolog.
6.- The handling and format of the questions and answers made by the human.

A logic agent can save and erase knowledge by "assert" and "retract" prolog’s statements in real time which change its behavior in the future actions. The information about the student is saving in the database and the agent knows when the same user visit the page asking name and id. The user receive personal attention.

2.7 Natural Language and voice

The agent’s main task is the understanding of the questions in natural language and answering [1]. This it is achieved in the following way:

Each word of the question is categorized in its syntactic group (article, noun, verb, etc.).
Each verb is then analyzed depending on the action it denotes according to its infinitive form.
A set of key nouns with priority are defined in order to reduce the search and creation of the answer. Examples of key nouns are: hotels, parks, social, etc.
Depending on the action the verb described and the noun with major priority found, a set of answers are created. The program keeps a record on the answers created, so even if the user asks the same or a similar question, the program can generate a different answer with relevant information.
A set of answer templates are used in order to reduce the time response.

The format of the rules is:

rules([[keyword, importance of keyword],[[pattern , [the pattern]], last response used, [response 1], [response 2], ... [response n]]]).

The agent’s behavior and its natural language are saving in the same database.

2.8 Programming the Web Site

The web architecture considered an environment for the development of the interaction between students and animated agents [4]. It is intended in Web technologies because of Java language features such as the aid of applets and classes reuse. These features allowed us to develop animated characters using voice, capable of reproduce text or verbally fragment speech generated by the user, ability to generate friendly graphical environments, to assist and inform users of the contents of a page Web, etc, everything in a simple and enjoyable way.
The animated agents were developed using Microsoft tools [7].
The Prolog language used was Amzi [9].

The server application was programmed in Microsoft Visual Basic .NET using ASP.NET. It has two main tasks:
• The communication with Amzi Prolog
• The handling and format of the questions and answers made by the user and the intelligent animated agent.

The School’s web site proposed in this paper has the following architecture:
3. Conclusions

Current tendency is to create web sites providing more dynamism, interactivity and attractiveness for the purpose of calling the attention of the user and facilitate the web site’s navigation. An animated intelligent agent that communicates with the user through written natural language gives the dynamism and the interaction desired.

Although in this paper was presented the implementation of an agent for a university’s web site, the proposed architecture can be used for any kind of web site where an agent with the characteristics exposed could be implemented. Agent’s functionality can be easily expanded and combined with different server’s applications so a totally different use can be achieved, providing an entirely different interactive experience to the web site.

Further research will focus on corporal expressions and spatial relationships using Prolog’s rules. This will bring a better integration in virtual environments using body and facial animation in human’s avatars, applying rules of behavior regarding its location within an environment’s space: a new kind of Virtual University.

References