

# TOWARDS A MULTI-AGENT SYSTEM FOR SUPPORTING THE ELABORATION OF FINAL PROJECT PROPOSALS<sup>1</sup>

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## ABSTRACT

Studies on systems for supporting both preparation and supervision of under-graduating final projects are still rare. Preliminary informal inquiries with potential users point out to the relevance of that kind of system, while confirming findings from literature that highlight the frequent difficulty for students on articulating a proposal. On the other hand, further extensions of such a system might be envisaged in order to account for more advanced projects, like master or thesis work. In this paper, we present part of our current achievements toward a Web system designed for aiding the actors concerned with preparing a proposal of under-graduating final project. The system relies on approaches such as Computer Supported Collaborative Learning and Multi-Agent Systems. As a matter of choice, in the paper we focus on this latter approach as a means to provide both students and supervisors with (local) information seeking and communication to each other (and/or colleagues), aiming to open up possibilities toward achieving a proposal.

## KEYWORDS

Asynchronous Learning, Learning Architectures, Multi-Agent Systems, Collaborative Learning.

## 1. INTRODUCTION

The accomplishment of a final project within an under-graduating course seems to be a subjective task, even if eventually a group-task. For the student, the engagement step required at the beginning of the work is rarely trivial to perform, since he/she is faced with the task of choosing/elaborating a proposal. On the other hand, the skill of the supervisor in identifying student's capabilities, preferences, limits, and needs is crucial for determining the kind of support that the student would need along the working out process. In the literature, one might find a considerable amount of initiatives under the form of guidelines on the (scientific) method for developing different levels of academic work, among which normalization manuals [Nahuz & Ferreira, 2002], discussions based on the autonomy degree required for students when entering the University [Severino, 2002], and advanced scientific work guidelines [Teitelbaum, 2003]. However, discussions focusing on the supervisor's perspective, his/her daily concerns and experiences are less vast. In this direction, we highlight the effort of Bianchetti and Machado [2003], organizing a collection of relevant work sharing that perspective.

A preliminary inquiry with students and teachers has revealed us some relevant features related to under-graduating final project. Decision making for teachers during the supervising process, even if following a specific method, is overall guided by individual experience. Students, by their turn, declare their needs on being encouraged and getting guidelines while looking for a theme. It seems suitable thus, for supervisors, to

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be aware of such needs in order to try to deal with them accordingly. His/her experience but also the quality of information at hand seems then to be useful for the supervision task.

As our purposes include the design of a Web system to support the elaboration of final project, we inspect the literature as an attempt to identify pedagogical support and computational systems dealing with similar problems. Generally speaking, we highlight a number of tools supporting Collaborative and Problem/Project-Based Learning [Donnelly and Fitzmaurice, 2005], and more specifically, let us point out the Workflow approach for guiding the development of final projects [da Rosa, 2003]. Besides that, we highlight also the classical yet warm Student Modelling approach [Self, 1990] from Intelligent Tutoring Systems/Intelligent Learning Environments, aiming to capture the student's features, experience, expectations, and needs.

In the meantime of our research project, we think to be able to benefit (of at least part) of each above approach. However, the identified problem is firstly suggesting us a complementary approach to deal with, from each individual perspective, the dynamics and the particularity of involved knowledge, and, from the whole system perspective, the non-linearity and asynchronicity of the process. Thus, the Rational Assistant Agency [Sallantin, 1997] approach and indeed an envisaged compound are being considered. In §2 we briefly introduce the notion along with the general architecture of our system as a society of rational assistant agents. In §3 we conclude the paper and point out to ongoing work.

## 2. ARTICULATING FINAL PROJECT PROPOSAL WITHIN A SOCIETY OF RATIONAL ASSISTANT AGENTS

Roughly speaking, a Rational Assistant Agent [Sallantin, 1997] is the one that interacts directly with the user, improving its knowledge accordingly, such as to help him/her to reason within a domain. Also, it is often able to perform inductive and deductive reasoning. We are currently considering the interactivity aspect, aiming to provide each teacher/student with an Assistant Agent (AA). AAs should yet be able to interact to each other. The overall architecture of the proposed system – named agenTCC - is depicted in Figure 1. Hereafter we briefly describe the main functioning of the system and, in Table 1 we summarize, inspired in Russell and Norvig [1995], the design of each agent in terms of goals, perceptions, actions, and knowledge.

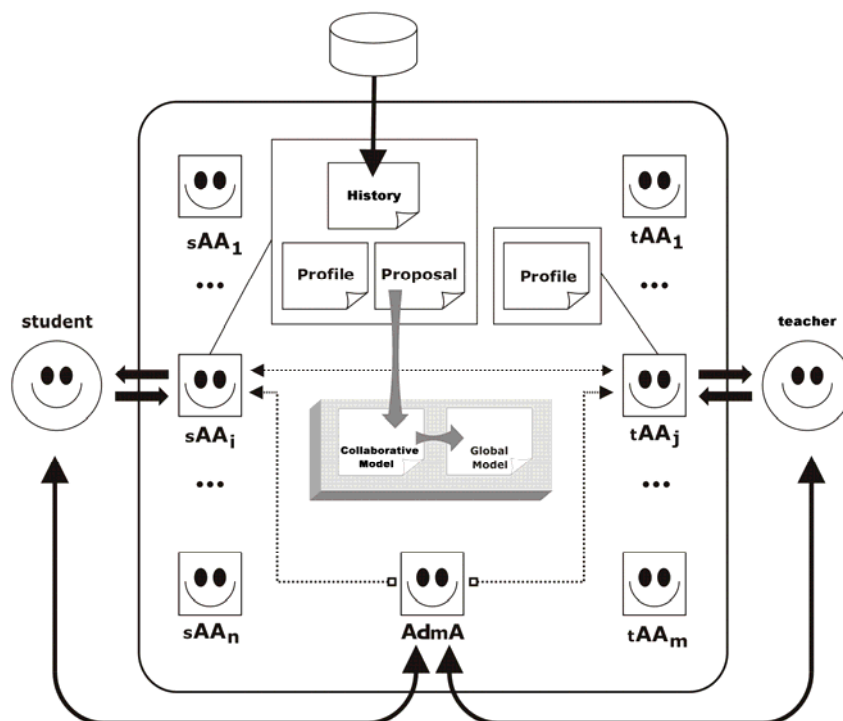


Figure 1. Overall architecture of a multi-agent system for supporting final project proposal elaboration.

Table 1. Summary of the main aspects of agents design.

Agent	General goal	Perceptions	Actions	Knowledge
AdmA	<ul style="list-style-type: none"> <li>•To maintain (life/status of) Assistant Agents</li> </ul>	<ul style="list-style-type: none"> <li>•Subscription request from user</li> <li>•AA wake up request from another AA</li> </ul>	<ul style="list-style-type: none"> <li>•To create an AA</li> <li>•To make an AA sleep</li> <li>•To wake-up an AA</li> </ul>	<ul style="list-style-type: none"> <li>•Information about time to make sleep AAs</li> <li>•Information about AA identification and knowledge (he knows who knows and how to find the one)</li> </ul>
TAA	<ul style="list-style-type: none"> <li>•To assist a teacher in supervising a student while elaborating a final project proposal</li> </ul>	<ul style="list-style-type: none"> <li>•Information request from an SAA about its knowledge on specific topics</li> <li>•Help request from SAA</li> </ul>	<ul style="list-style-type: none"> <li>•To inquiry the teacher in order to improve his/her profile</li> <li>•To inform teacher about students needs</li> </ul>	<ul style="list-style-type: none"> <li>•Teacher's profile</li> </ul>
SAA	<ul style="list-style-type: none"> <li>•To assist a student in elaborating a final project proposal</li> </ul>	<ul style="list-style-type: none"> <li>•Students requests for information seeking on chosen topics</li> </ul>	<ul style="list-style-type: none"> <li>•To inquiry the student in order to improve his/her profile, and to find out needs</li> <li>•To provide (to search and to inform) the student relevant information according to his/her history, profile, and (ongoing) proposal needs</li> </ul>	<ul style="list-style-type: none"> <li>•Student's history</li> <li>•Student's profile</li> <li>•Student's (ongoing) proposal</li> </ul>

In order to get inscribed in AgenTCC, a user – intending to play the role of either teacher or student - interacts with the Administrative Agent (AdmA), which has anytime an *Active* status. As a consequence, the AdmA creates an Assistant Agent (AA) for that user (AA with *Active* status). We distinguish two kinds of AA, namely, Teacher Assistant Agent (TAA) and Student Assistant Agent (SAA).

Whenever a user finishes his/her activities within the system (when a student delivers his/her final project proposal or yet when a teacher leaves the institution), the *Sleeping* status is assigned to his/her AA. On the one hand, the idea is to keep as Active only AAs assisting users who are using the system in the concerned academic period (a semester, for instance), both students and supervising teachers. On the other hand, we find it relevant to keep AAs knowledge for eventual latter use by others. In this case, a Sleeping AA may temporarily assume a *Wake* status in response to a demand from an Active AA.

A TAAs knowledge is progressively improved by means of interaction with the teacher it assists. Such knowledge includes interest topics and related literature, research projects, and final projects (closed or ongoing supervisions) or yet theme proposals. The TAA receives a number of requests from SAAs, including information requests about teacher knowledge or, during supervision processes, help requests.

A SAA knows the History (from the institution's database) and Profile (modelled both explicitly and implicitly) of the student it assists. Also, the SAA knows the Proposal under elaboration. Such a Proposal is initially corresponding to the structure required by the institution for final project proposals, and is gradually increasing as interactions in AgenTCC take place. Starting from student's both History and Profile, and also consulting the society of TAAs, a SAA proposes him/her an ordered list of themes. In addition, a SAA suggests to the student some related readings, after consulting TAAs and/or other (active/wake) SAAs.

In order to recall collaboration, the so-called AC-Hybrid "architecture" [Castro *et al.*, 2004] is a model that organizes asynchronous collaborative work within three levels: Individual, Collaborative, and Global. The Individual level accounts for the organization of ones ideas in a private workspace, before one is able to propose his/her work to the group. Within the Collaborative level, group members may discuss asynchronously incoming suggestions. The Global level represents the group consensus in a given time

during a product preparation. A discussion is triggered on the Collaborative level whenever a group member intends to suggest changes in the current Global level.

The AC-Hybrid “architecture” is being exploited here for a couple of purposes: (i) to allow the supervisor’s awareness and regulation, and (ii), to allow collaboration between groups of students working around a single final project proposal. With respect to (ii), the Individual level is corresponding to the workspace of a student. The Collaborative level accounts for discussions between students before releasing one version of (part of) the work to the supervisor. The Global level keeps a released version. By his/her turn, the supervisor may intend to suggest improvements to a released version. This is accomplished by allowing him/her to take part in the Collaborative level as well. With respect to (i), when a single student is working around a proposal, the Collaborative level is then allowing discussions between him/her and the supervisor. Finally, the work of SAAs and TAAs regarding AC-Hybrid is as usual with respect to the Individual level, and is extended to detect events in the other two levels, such as to inform the user being assisted.

### 3. CONCLUDING REMARKS

In this paper we describe a system for supporting both students and teachers during the elaboration of final project proposal. The design of the system relies mainly on the multi-agent systems approach, as well as the rational assistant one. Also, computer supported collaborative learning is recalled to account for regulation from supervisor, and yet for collective elaboration of a proposal by a group of students.

In spite of the relevance preliminarily perceived around the theme, considering both literature and informal inquiries with potential users, efforts on that direction seem still rare. Ongoing work within our teams includes implementing the Web environment and submitting it to real using situations. Yet, we include in our research agenda accounting for the whole final project elaboration, beyond its proposal.

Moreover, as a considerable amount of work appear in literature dedicated to global Web search, we decide to invest in a local scope regarding the institution information (previously accomplished work, supervision availability and interests, etc.) such as to complementarily guide the student. On the other hand, being global search quite relevant for academic work nowadays, we envisage integrating in agentTCC a number of existing tools such as to support literature review.

Another possibility we foresee is to extend system’s design and use to support more advanced projects like master and thesis. In such a context, the rational agent approach might be deeply exploited, considering (inductive/deductive) inference mechanisms to aid on hypothesis formation and testing.

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