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AGENT BASED UNIVERSITY PLANNING OF SAKARYA UNIVERSITY: "CAWIS" PROJECT

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ABSTRACT

The core aim of Agent Based University Planning project of Sakarya University is designing and implementation of a system that is based on Distributed Artificial Intelligence technique for scheduling and planning to face the problems that often takes place in a university administration division. This report particularly focuses on course planning, resource allocation, class timetabling, and office allocation, exam scheduling and other administrative and organizational bureaucracy of a university. Our goal is to define a hierarchical multi-agent architecture for the university administrative functions and design and implement a personnel agent for each entity stumble upon in that division. Designing information storage and distribution agents for the university environment is the key objective of this project.

Keywords: CAWIS, Agent based university, MAS University

1. INTRODUCTION

Agent-based systems technology has generated lots of excitement in recent years because of its promise as a new paradigm for conceptualizing, designing and implementing software systems. This promise is particularly attractive for creating operating system software in distributed and open environments, such as the internet. Currently, the high majority of agent-based systems consist of a single agent. However, as technology gets more advanced, addressing complex applications increases and the need for systems consisting of multiple agents that communicate in a peer-to-peer fashion is becoming apparent. Central to the design and effective operation of such multi-agent systems (MAS) are a core set of issues that arises many questions and providing precise answers to those questions required great amount of experimental researches that have been conducted over the years. [1],[2],[3].

Professors and university staff have many different type of work to prepare. University resources (time, money, classrooms etc.) need to be allocated in a detailed manner by staff. Scheduling and planning of exams must be done in exact time by professors. Campus Automation Web Information System has been designed to control University's administration and education system. Many procedures related with educational and non-educational programs in a university environment are supported by the outcomes of this project.

2. WHAT IS CAWIS?

CAWIS [4] stands for "Campus Automation Web Information". CAWIS or "Campus Automation Web Information System" is a project that is being developed by the IT (Information & Technology) department of Sakarya University. CAWIS is an operating system and the brain behind everything that need to get done in AD (administrative department) and helps the broader computing admin system by addressing all functions that need to be addressed. The ultimate goal of the project is to control all the university's user groups such as students, professors and university staff from within one framework; it will allows users to access their accounts in a secure environment and also accelerates the fellow of information in the University

The establishment of the web services needed for users as well as constructing user substructure of the university in order to be controlled over the web is also part of the CAWIS project. Database of users who have Sakarya university e-mail accounts is included in CAWIS project. An agent can collect information by using this database.

Construction of the CAWIS project started in 2001. The project was launched to provide services in 2004. Improvement in progress has been made and some new functions and services have been added since then. The CAWIS is the biggest software automation project on education system for Sakarya University.

2.1 Benefits of Project

- Before the launch of CAWIS project, students had to go to their 'Institutes' to request information for the classes, registering for their needed units or courses, accessing to their grades, following announcements and etc. They were wasting so much time for administrative issues.
- CAWIS enabled students to register for the classes and take courses by using "webobis" agent. They can follow their grades (Fig.7); ask questions about their educational problems by communicating with the admin staffs via their "webmail" accounts. They can have access to updated information about course s and calculate credits and their many other needs from freshman up to their graduation.
- At the beginning of semester, professors have to take list of their students, and they had to reach every single student to provide information about courses, books and any materials or equipments that was required for the course.
- With CAWIS project, professors are able to see detailed information about the students who have registered for the course; create a course group in a short amount of time and start to communicate with them by using "webform" agent. Professors can upload student's grades on the system during the term or semester. Students also can access to their grades from anywhere in the globe; and forward their questions to their professors or send their objection if they have any in regards to their grades.
- Processors had difficulties to communicate with their students before the launch of CAWIS system. In case if a professor had a health problem or was absent, then his/her students were unable to reach their professors and could not take any notes for the class lecture.
- Now, all the students who have registered for a unit can see and download lecture notes giving by their professors from anywhere in the globe by using webabis agent. Professors also can send extra notes for the students upon their requests.
- Students can create e-pages and communicate with each other via CAWIS system.
- Students can have an on-line discussion by using CAWIS with their professors at the time when a lecture is being given.
- Administrative staffs had to follow the student's educational status manually before the launch of CAWIS, or at the end of the semesters they had to rush in order to finish course tables. Many errors could occur at these periods.
- Now the staffs can follow every phase of the student's educational status via CAWIS. CAWIS System calculates credits automatically. Most of processes related with education will be completed at the end of the terms or semesters. The Staffs can instantly inform the professors or the students if any problem occurs about credits, grades and etc.
- Administrators can send official announcement to the student's email address. For instance if a student has military (Selective Service) problem, an admin can communicate with the student and ask him to provide any documents that are needed to complete their registration. The Student can send any type of documents to the administration department by using "webmail". BTW it need to be said that, other e-mail address such as –yahoo, gmail etc- can not be used because they are not part of registered official institute's cyber domain.
- Professors had to prepare many grade tables and give them to the administration on time before the launch of CAWIS system. These procedures were taking their valuable time, and they could find little time for their academic studies. CAWIS solved these issues and now, professors no longer have to deal with these issues in the institute.

3. CHARACTERISTICS OF AGENT

Agents are often described as entities with attributes considered useful or often critical in a

particular domain. The term agent came to be widely discussed or used within the Distributed Artificial Intelligence (DAI) field [5]. A main issue of DAI is how to allow autonomous agents to model each other and give reasons about the activities of other agents. The research's effort is concentrated on answering the question of suitability of an agent-based approach to design, starting from a domain dependant on descriptions of the tasks, development of agents for different functions, finding a communication protocol or common language and applying the developed environment on specific domain problems. The dynamic characteristics of an agent system present opportunity to create new type of applications that can integrate several approaches in application development [3].

Now you might ask; what exactly is an agent? In agent research; there are varieties of definitions for the "AGENT". According to Russel and Norvig [5], "an agent is just something that perceives and acts." An agent has its own capacity dependent of their roles, skills and environment [6]. According to one of the definition: "Agents are computational systems that inhabit some complex dynamic environment, sense and act autonomously in this environment, and by doing so realize a set of goals or tasks for which they are designed for" [7].

Multi-agent systems (Fig: 1) are designed as a collection of interacting autonomous agents, each having their own capacities and goals that are situated to a common environment. This interaction might involve communication, i.e. passing of information, from one agent to another and their environment.

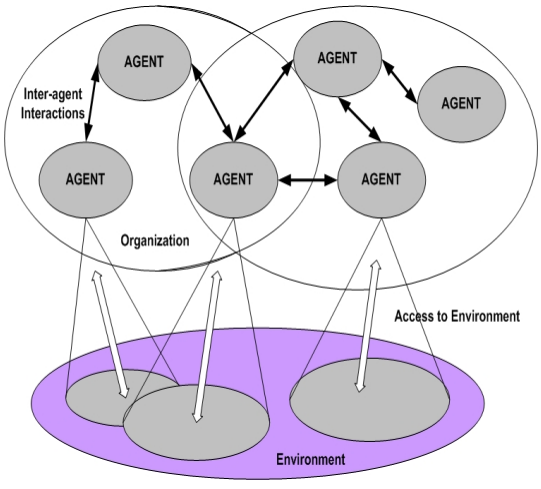

Figure 1: Multi-agent systems [8]

The research here is concerned with coordinating intelligent behaviors among a collection of autonomous agents; how these agents coordinate their knowledge, goals, skills, and plans to take action and solve problems [9],[10]. All agents' actions are derived from rules embodied into the agent, which depend on local information accessible to the agent [11]. An agent possesses some sensors to perceive the environment within it moves, and some effectors to act in this environment. Basic agent architecture can be seen in Fig. 2.

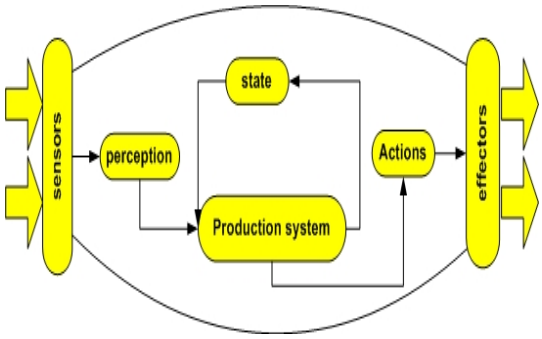

Figure 2: Basic Agent Structure [13]

4. OBJECTIVES

The main objectives of the system;

- To address course planning, resource allocation, class timetabling, office allocation, exam scheduling and all other administrative procedures in a university
- Defining a hierarchical, multi-agent architecture for the university environment.
- Design and implementation of a personal agent for each entity involved in the university's administrative environment.
- Design and implementation of information, storing and distribution agents for the university environment or bureaucratic producers.

Student's Agent from of CAWIS project can be given as an agent sample in Fig.3.Basic data structure can be seen in this sample. Many documents that are needed for students and professors will be prepared autonomously by this agent. Once data is entered into the system there will be no need for replication of required data. This agent will send data to the professor's Agent also.

SAKARYA UNIVERSITY
STUDENT MAIN DATA TABLE

This form must be submitted with the license application of education programs in Sakarya University.

Student's last name	First name	Courses
Address	**Turkish ID number**	**City**
University ID	**Faculty**	**Superviser of student**
Name of program	**Date of birth**	**College**

Fig. 3: Student Agent basic data structure

5. CAWIS MODEL

MAS systems are also referred to as "self-organized systems" as they tend to find the best solution for their problems "without intervention" [3]. In CAWIS project six basic agents were defined as written below.

Agents of CAWIS project (Fig.4):

- Students Agent (WebGate,WebObis,WebMenu)
- Training and Learning Agent (WebAbis,WebForm)
- Lecturer Agent (WebGate,WebPhis,WebMenu)
- Infrastructure Agent (WebRehber)
- Task Agent (WebRehber,WebPhis)
- Strategical / Goal Agent (WebForm)

While information is situated in a particular environment, agents perform their actions. This environment can be a computational one. CAWIS is a web based operating system and a computational environment. For instance “sendmail” is a very popular (simple) agent that runs in background of communication system [7]. One can easily send an email to anyone but can not see the whole process. “Sendmail” agent goes through many stages by the name of the sender.

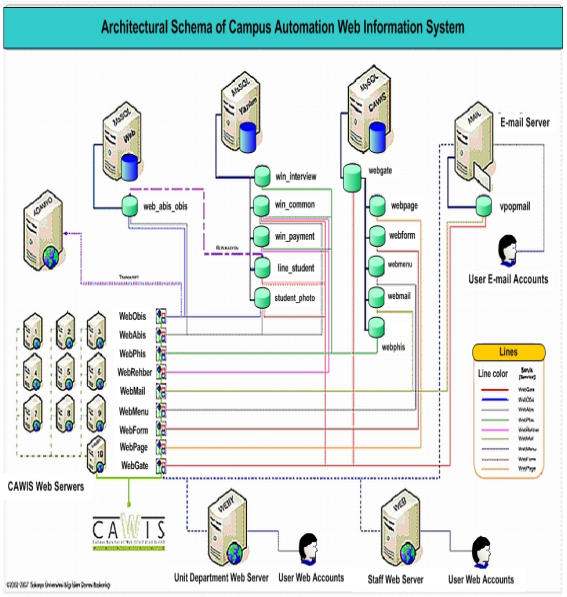

Figure 4: Architectural schema of CAWIS

A learning agent shell includes general problem-solving and learning engines for building a knowledge base consisting of an object learning that specifies the terms from a particular domain, and a set of problem solving rules expressed with these terms [12],[14]. A learning agent was used in our study and it is considered to be multi-agent learning because the learning agent has a cooperating and an adversary agent with whom it learns to interact.

6. AGENT-MODEL FOR SAKARYA UNIVERSITY

*Academic calendar for next education season is planned by the university senate a year ahead, and these dates are inputted into Automation Software of Office of Registers. Information about selected students by OSYM (Student Selection and Placement Center) is passed electronically from OSYM. (We have strategic objectives to increase the rate and number of students placed in top 1%)

*There are various software’s to transform this information and enters them into the system. Student’s information (including their photos) is passed into automation environment (Fig.5). Internet user accounts are automatically opened by using the same information. Student IDs are prepared.

Figure 5: Student Information

*When students want to register, they need to submit their high school diploma and receipt of tuition and fee payment, then student certification, student ID, Internet user information form and explanatory information are given to them and then their registration is considered to be completed in a short amount of time. From this point on, the students can access their accounts by using WebGate (Fig.6)

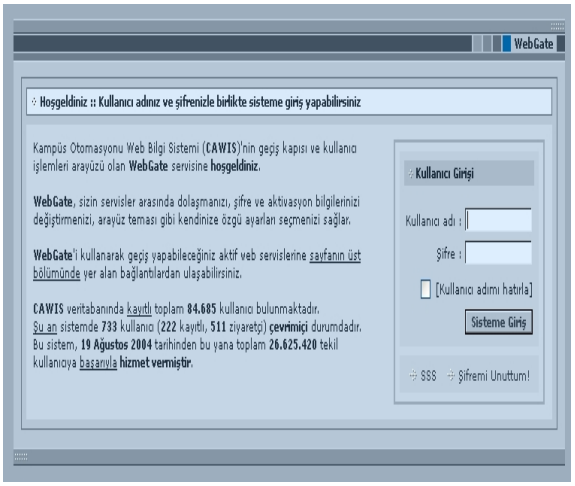

Figure 6: The entrance page of Student Agent

*When registration are due and deadline is closed, all, identification and Internet user information of the students whose registration is not completed, get deleted from Automation System of Office of Registers. But for those students who have completed their registration, all the compulsory course information is automatically assigned to them by using Automation Software of Office of Registers.

*For the web-based courses (online classes) distribution of students into courses as well as opening student accounts for web-based education platform and student contact forms are automatically preformed.

*Following the assignment, instructors can see the list of students and define the additional grades to be earned from mid-terms and final exams by using 'Academic Information System' (WebAbis) in CAWIS.

*Instructors keep the record of all grades such as quizzes, mid-term exams, homeworks and other performance which is needed to evaluate activities via internet by using WebAbis service. Following the instructor's input, students can see their grades on 'Student Information System'; WebObis (Fig.7).Students also can see detailed information about their professors in WebPhis (Fig.8)

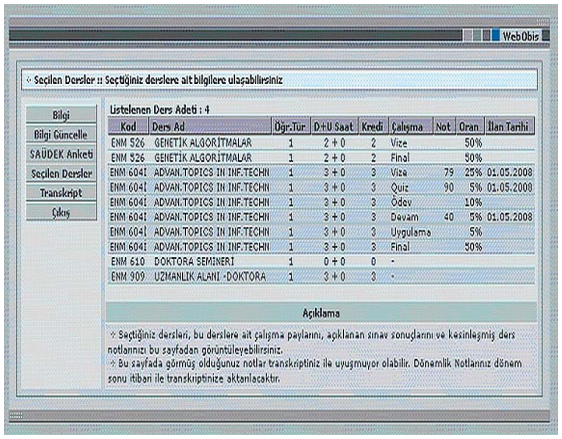

Figure 7: Student grades

Figure 8: Lecturer Information

*Final exams are taken at the end of each term or semesters. The Final exams grades are recorded by the instructors via internet by using WebAbis service and then a curve applied to the grades and state of success/fail is determined and recorded.

*Before the beginning of a term or a semester, students determine the courses they want to take and can register online by using WebObis service.

*Following the registration, students' course registration information in the database gets transferred to the Office of Register Automation Software.

*During the term or semester, other compulsory activities such as internship can also be checked via internet and internships completed by the student are transferred to the Office of Registers Automation Software.

*Graduation processes are performed for the students who completed their courses and internships successfully. Diplomas, diploma supplements and transcripts of graduated students are prepared automatically.

*At the end of the terms or semesters and within the strategic plan, number of failed and graduated students, course and instructor evaluation questionnaires are taken from automation system, then necessary measurements and evaluations can be made, and rates of reaching strategic targets could be determined.

7. CONCLUSIONS

In the beginning of this project we realized that not much study about an agent planned university have been done in this country. We believe that universities in this country should become more productive professional institutions in the future. We made a plan for an agent based university and started working on this project by knowing that the completion this project in a short amount of time is almost impossible. We should emphasis that establishing many agents is time consuming.

There are many engineers from different disciplines cooperating or directly involved in this project. We can name a few professions such as computer engineers, data managers, industrial and system engineers, electrical engineers and etc. We were able to find out that most of the enabling technologies and tools necessary to support the Agent Based University Model (CAWIS), as well as many valuable applications already exist and even some of them are already in operation, but most of them have been developed dispersedly for some reasons which are not our concerns. We designated as an adequate environment, integrating these technologies and able to efficiently respond to this model. These agents (agents of this project) have high advantages, including flexibility, simplicity, and quicker development times. However, their creation does require some expertise, which is slowly spreading across the entire Sakarya University. The other problems are minor issues which will be solved as more resources (human and equipments) get dedicated to the project.

We believe agent design is some thing that will eventually become imperative. However, as the agent becomes more complex due to increased requirements, modularity will become vital. That's a key concept of our project. To date, the only reliable way of organizing these modules require human design.

This paper attempts to make progress towards making an agent structure of Sakarya University. Although it is time consuming, we are trying to establish "a highly productive university" for students, supervisors, tradesman and venders of Sakarya city. The long term goal should be a full agent structured of the Sakarya university systems.

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