

INTELLIGENT AGENTS AS IT SUPPORT FOR COMPANIES

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Abstract: An important trend in modern computer science is the implementation of intelligent agent-type systems. The objective is to distribute the processing operations to a group of agents, a process by which to obtain efficiency and productivity that is lacking of knowledge-based systems previously implemented. This technology has established itself in recent years as a reliable option for the development of complex distributed software systems that operate in dynamic and open environments. The concept of intelligent agent, is considered in the literature as an interdisciplinary element belonging to both computer science and artificial intelligence. Certainly is that this technology has a crucial contribution in various fields: planning tasks, data mining, production planning, supply chain logistics, electronic commerce. By using these intelligent agents, it can perform tasks at a company more quickly and without human intervention, and getting the necessary information in real time (delivery terms, return the product, service, credit, dealer reputation, privacy, etc.).

In this paper, I intend to develop the applicability of using intelligent agents in the electronic commerce. In this regard, I will first present a brief history and some definitions of software agents, such as autonomous and intelligent agents, several classifications and areas of application after which I proceed with to a presentation on the general applicability of agents in e-commerce. Thus I shall approach their operational mechanism, multi-agent systems in e-commerce, benefits, and finally, the limitations of these technologies.

Keywords: intelligent agents; electronic commerce; multi-agent systems; environment; company.

1. Introduction

Knowledge-based systems have been imposed in recent years as a reliable option for the development of complex distributed software systems that operate in dynamic and open environments. Agent-based software systems have emerged from the need to conduct software capable of operating in a dynamic and heterogeneous environment. Basically, the software agent can be defined as a software product able to act on behalf of a human or artificial user a load to achieve a well-established.

Software agent is regarded in the literature as an interdisciplinary element belonging to both computer science and artificial intelligence. Until now, however, did not reach a consensus on the definition and classification of software agents, but the definitions of a few authors with certain notoriety, it achieved in time a wide acceptance. Developing software agents have made significant contributions in key areas such as planning and production tasks, data mining, supply chain logistics, electronic commerce. In this regard, different tasks can be performed at a company more quickly and without human intervention, getting the necessary information in real time.

In this paper, I intend to present the applicability of using intelligent agents in the electronic commerce. In the first part, we made a brief history and I gave some definitions of the concept of software agents, both the autonomous and intelligent, a series of their classifications and the main areas of use. Later, I made an analytical presentation of the agent's applicability in e-commerce, addressing their operational mechanism, benefits, and finally, the limits of these technologies.

2. Brief history of the software agents

The first steps in automating information work, were MRP systems (Material Requirements Planning) which were followed, shortly by the second generation of software packages for MRP and finally of ERP packages.

The MRP was initially useful for the efficient management of material consumption, allowing the user to enter the exact materials and quantities needed to produce one unit of each product of the company and then detailing the production plan (with the exactly quantity of products that would to achieve in the next period). The program provides a report on materials and related quantities required to be supplied, and can determine the rate of consumption and also be able to estimate the rate of supply to ensure the safety stock. The facilities offered by the MRP were very helpful but only for large companies, who had in the management multiple branches quite strong, located in various corners of the world.

The next generation of MRP software, was focused on the needs of human resources and propose an optimal calculation of human resource needs for different levels of production and it's scheduling in order to meet the deadlines. The accounting modules have been extended to be able to generate (sometimes ad hoc) reports complete and useful for top management.

With the expansion of the use of such software, it sought new solutions to support managers and thus appeared ERP systems (Enterprise Resource Planning), which provided the companies an integrated system for all activities. Being an integrated, this software has a single database, to which users have access to all levels of the company on the basis of granting access rights.

The next step in the evolution of enterprise software systems has been the development of software systems based on intelligent agents who enable the assignment of all repetitive tasks fully some autonomous agents. An agent is considered autonomous if, after receiving a task, a carried out without any human intervention, been thus an independent system. In this respect, there is a massive reduction in costs and time spent working in the organization of information and can enable employees to concern only those non-repetitive tasks that are really challenging and are not yet automated. A consequence of the use of intelligent agents is materialized in building some EDI VAN networks of wide area that can interconnect a number of corporations, to integrate services into a single system of production management.

A significant example, in this regard, are the companies Boeing and Airbus working with thousands of business partners to produce commercial aircraft. Basically, network environment, is the means by which intelligent agents will be integrated with ERP solution to each member company of the network, realizing:

- ✓ automatically tracking the rate of consumption of materials;
- ✓ estimate the remaining time until stocks are exhausted;
- ✓ finding business partners that can achieve optimal supply;
- ✓ knowledge of all the restrictions in the system (the time required to achieve delivery, asking price, etc.);

- ✓ automatic generation and management of contracts, by calling the document management module integrated in ERP solution, with all relevant clauses; access to electronic payment systems used by the company for various transactions.

After analyzing these opportunities offered by the use of intelligent agents, we can draw major benefits to businesses: reduce the cost of traveling for business, the specific supply cost and the possible elimination from system of human operators. Given that intelligent agents could be implemented in the scenario described above, all operations and transactions should be initialized and completed in a time so short, that the human operator could not follow and respond timely to changes in the system. Thus, the man would not have a useful role or place, in the activities environmental of network which are allocated of the software agents. There may be a significant disadvantage, such as the cost of failure in securing the system, which would be very high and the IT department would require additional funding.

3. The concept of intelligent agent

The notion of agent has been used by McCarthy J. since the 1950s, and was then detailed a few years later, at the Massachusetts Institute of Technology, along with Selfridge O. G., in a project. Thus, they defined the concept of software agent as a computer system, that at receipt an objective, would achieve the processing needed, and in the case lock, it can ask and receive advice, offered in human language. Since then, a series of researchers in the field have studied this new concept, each with their own opinions. An important contribution to shaping the theory and methodology of software agents, have it had object oriented programming, concurrent object systems and human-computer interface design.

Genesereth R. M. and Ketchpel S. P. (1994), considers autonomous agents "a system placed in an environment that reacts to this environment and acts on it in accordance with a target".

Maes P. (1995) estimated that agents autonomous are "computational systems that populate a complex dynamic environment, perceive and act autonomously in this environment, and thus realizes a set of goals or tasks for which they were designed." The definition takes into account the environment and agent autonomy, but stresses the need for the types of environment to be complex and dynamic.

Franklin S. and Graesser A. (1996) have defined an autonomous agent as "a system situated as part of an environment that perceives its environment and acts on it, over time, following their own agenda, in order to affect what it considers as being the future". They believe that when describing an autonomous agent, they actually describe the environment, sensory capabilities, actions, motivation, and action selection architecture.

Nwana S. H. (1996) distinguishes two periods in the research of the software agents. The first period begins in 1977 and the second in 1990. First period is rooted in DAI (Distributed Artificial Intelligence) and helped to define the interaction and communication between agents, the decomposition and distribution of tasks, coordination, cooperation and conflict resolution through negotiation. In the second period the focus was on concrete implementations of software agents, studying the typology of agents and how collaboration in the network.

Shoham Y. (1997) state that an intelligent agent "is a software entity that operates continuously and autonomy in an environment often populated by other agents and processes."

Jennings N.R. and Wooldridge M. (1998) defined software agent as "a process able to react and initiate changes in its environment, possibly in collaboration with users and other agents." Concrete applications of the software agents have some common features: they were designed and built for a definite purpose, are autonomous and react to their environment. To achieve its objectives, they must interact with other agents, but because agents are autonomous, these interactions are complex and require cooperation, coordination and negotiation.

Wooldridge M. (2000) considered the agent "a computer system located in an execution environment and capable of autonomous action in that environment in order to meet planned objectives." The definition does not mention the type of environment because the environment can vary. In general, an agent has no control over the environment, but only partially, it can influence.

Basically, in the definition of software agents are outlined two branches: one which regard the agent as a behavioral entity, and another that is based on the description of the attributes of the agents (Buraga, S.C., 2001):

- ✓ agents as behavioral entities in which information systems behave like entities in an autonomous manner, perform various actions with a certain level of response and displays attributes such as learning, cooperation and mobility, assisting users in their activities.

- ✓ agencies as a description of their attributes: reaction, autonomy, collaboration, communication, inference, continuity, personality, adaptability, mobility.

Individual behavior of the agent is determined by a complex interaction between its internal states and external influences such as environment or other agents. Thus the exact trajectory of an agent, can be known only at run time of the agent in the environment. Due to the complexity constructive, the agent behavior becomes clear only at runtime. These implications are very important in critical areas such as air traffic control.

Buraga S.C. (2001) outlined four major criteria for the classification of software agents:

- artificial intelligence, software agents have been evaluated based on the ability to solve problems:

- ✓ reactive agents, record the reactions to changes in the environment or to the messages received from other agents;

- ✓ agents intentionally, shall draw up its behavior taking into account the 'intentions' and 'belief', creating action plans and executes them;

- ✓ social agents, is based on models drawn from human society and working with other agents in the agency.

- primary attributes: have the following categories of agents: collaborative, of interface, mobile, computer / internet, reactive, hybrid intelligent;

- distributed computing, in terms of this criterion, there are mobile agents, which can be defined as software entities that run in a software environment and includes an agent model, a model of the life cycle, a computational model, a model the security, a model for communication and a navigation model;

- types of software, software agents are delimited by control structures, operating environment, programming language and its applications.

Many times, in practice, it is necessary to address the multi-agent architecture (simulating interactions between groups or organizations, solving in distributed mode problem, etc.). The advantage of using these systems is given of robustness (due to the fact that the tasks are divided among several agents if one falls, the system no crashes) and scalability (with a modular architecture, new agents can be added to increase yield).

4. Applications of the agent-based software technologies

According to Haag S. and Cummings's M. (2010), there are implementations of software agents following categories:

Shopping agents - explore the internet looking for information about goods and services and works very effectively for common products such as CDs, books, electronics, etc.

Personal agents - acting on behalf of the user being able to perform operations such as:

- check emails and announces receipt of important messages;
- at the user request seeking information on the area of interest;
- search the jobs on Internet and submit your resume for positions that meet certain criteria;

- prepares the news reports on requested domain;
- play computer games as acting as of opponent;
- synchronizes user profile on the various social networks;
- scans web pages and highlight important fragments of the user;
- the user completes the online forms and retains information to automatically fill in the future.

Data mining agents - are used to identify trends and patterns in information from multiple sources, information which are found in a data warehouse. This information can then be used by people for various purposes. Agents for data mining can detect through trends and key indicators, the major changes or opportunities can even alert the user.

Software agents for monitoring and surveillance - working on a computing device and are used to observe and report various situations, such as: tracking inventory levels, price of the competitors, evolution scholarship and possible information leaks. An example, would be the monitoring agent from NASA laboratories which inventories, planning and pursues food supplies.

Network and communication agents - this category includes agents for filtering and automatic sorting of the e-mails, server monitoring, exploration of the Internet in order indexing for a search engine(egg spiderbot for Google) that browsing on WWW, which scans the environment in a particular area to identify wireless networks, management agents on telecom devices, for crowd simulation in order to take safety measures.

Auctions agents - these programs try the integration on the basis of algorithm of the rules and conventions of specific bidding auction theory. These include algorithms support for managing by the agent a several bidding systems (English, Dutch, open, closed, Vickrey, etc.), but and of the seller or buyer. The elements to be integrated effectively in software include: price fixing mechanisms (the highest price allowed, the lowest acceptable price, etc), rules for conducting the auction, bidding step, participation many-to-one or many-to-many,

the closing auction, relevant user information management, tender with a good single or multi-product, where permitted - management of the second price.

E-learning agents. The limits of the current e-learning systems can be overcome by integrating learning agents (software agents specialized). The advantage lies in the ability of the agent to work with each individual, in personalized mode, providing just the necessary study materials and at the right time. Also, may aid teachers in the design of courses and teaching. Learning agents are able to pursue learning goals, to adapt to the characteristics of the learner, to take into account prior knowledge of it and facilitate interactive learning.

Agents with capacities of rationality - presents features similar work of human reason and can be implemented using specialized integrated programming environment in tool writing software agents called NUI. They operate on the BDI model - Belief, Desire, and Intention and can work with structured knowledge using data type's integer, real, Boolean, string, symbols. Using BDI model, we can define rational software agents, i.e. agents that select their mode of action on the basis of practical reasoning.

5. Using intelligent agents in e-commerce

Functioning mechanism

In recent years, we see that the volume of information available on the Internet, as and the number of traders who trade business trading in network, has massively increased, in an exponential rate. This has led to the need for to have more advanced software to surf the multiplicity and diversity of information, in order to find the required user. In this sense for the business, has developed shopping intelligent agent that is able to automatically navigate to search for useful information. From the point of view of the functioning mode, software agents permit interaction the automated which lead to an optimization of business transactions.

A very simple model for e-commerce software agents may comprise the following steps:

1. a shopping agent supports multiple proposals from various sales agent;
2. every proposal defines a complete offer including product configuration, price and other related services provided;
3. the shopping agent Evaluates and ranks these proposals based on the criteria of satisfying of the consumer demands which it serves;
4. whether the client is unhappy with the offers, it can criticize, starting from one or more dimensions;
5. shopping agent transmit these preferences sales agent, which in turn uses to makes new offer.

According to this model, assuming that we want to buy from the Internet a DVD with a particular film, we establish in the interface displayed, type of product (DVD) and movie title. The agent starts running, and will search in a predefined list (and very large) of known sites, displaying at each site offer price. However, the agent can perform a restrictive search based on certain criteria (time required delivery, warranty duration etc.).

In recent years they have developed a series of intelligent software agents, based on conduct research projects . In this regard, recall the Global DSE (Global Dynamic Service Environment) project, which aims the development of software agents that operate in a

competitive environment to achievement automated of B2B trade exchanges. According to these software agents, each component company of the "integrated environment" , launches the several agents that represent their goals , and they interact with each other. The objective essentially is automation of negotiation and contracting of routine products from the procurement of the large companies. Through this project arose new channels and opportunities regarding automation of supply, leading to a reduction in cost and time required purchase. Based on this framework, we can build different business models for sellers and buyers, and may even allow the automation of payments for various transactions.

Multi Agent Systems in e-commerce

To achieve multi-agent systems, agents may have a multitude of planners, each with a set of specific, sometimes even contradictory to others, which causes agents to enter into a particular competition or cooperation.

In electronic commerce, multi-agent systems have many uses in sub domains as: making decisions based on rules of economic need, solve problems by mimicking the human intellect, data classification, diagnosis specific situations transactions commercial, planning, acquisition and processing of e-mail messages, comparisons, searching for useful information on the Internet and negotiation.

Intelligent agents are based on representation in the virtual environment of all entities involved in commercial transactions. Thus, the consumer can be represented by a shopping agent that interacts with a salesperson. Shopping agent needs to announce need a product or service, and sales agents of the various traders bid to meet the need. Consumer agent collects bids and selects on the most favorable, and sends the result to the sales agents and ask a negotiated sale, in which case, salespeople will bid again based on previous results.

Benefits

The main benefits of using intelligent agents in e-commerce materialize in:

- ✓ reducing the degree of use of network, intelligent agents system allow server transfers, we bring the data to the application, not send data to the application;
- ✓ reducing transaction execution time, which in particularly dynamic modern economy is a basic factor;
- ✓ intelligent agents are independent of hardware and network implementation, its depend only software execution environment installed on any system (Java Run Time Environment);
- ✓ reducing the cost with the tasks that can be taken automatically of a specialized software agent (automatic filtering of emails and sometimes processing their contents in order to generate a response of the transmitter); enables better service of the company customer who send various questions, but their appropriate response is a routine;
- ✓ concluding the contract automatically by software agents, the agent who represents the buyer enters into the contract with the agent representing the seller, both to meet in the virtual environment;
- ✓ possibility of software agent to inform on the internet to find the lowest price for a product demanded by this user.

Limits

Software agents are made in order to generate consumption of resources (computing) as low. However, some of the resources will be temporarily consumed by the agent during execution on the server. If a server accumulates an excessive number of agents, generate a total consumption which will slow or stop the server can even lead to depletion of equipment and can be assimilated to a DoS attack (Denial of Service). Are exposed to this risk all companies which open their computer systems (especially database servers) to the public. At aggravated risk, are exposed to who offers this free access to register a user account.

Even if there are rules against access to data and public systems by software agents their imposition is at least difficult given the increased flexibility of software programs such agent. One possible solution is the disappearance of free access to information (one of the main directives of the WWW) and the transition to fees for consulting databases in order to financially support computer systems that run agents from worldwide.

In the e-commerce community there is opinion that software agents technology represents a major risk for both the target servers and home servers regarding illegal access to data, or data theft, obtaining computing resources for free, unauthorized execution of a program, data corruption on the server, depletion resulting visited servers DoS attack (Denial of Service), the duplicitous behavior of the agent.

Another issue to be considered is the issue of data ownership. Some entities regard the information freely available on the Internet as "public domain", while other entities concerned consider property as a legitimate one.

6. Impact of implementing of the technologies based on software agents

Software agents provide a lot of user benefits such as automation of repetitive tasks and complex, but show certain effects that should be considered before implementation.

Organizational impact. The changes made of the software agents affecting e-commerce, the operational sector and raises serious safety problems. They are able to quickly search the Internet to locate the best deals available online and provide this information to the user in seconds, saving time and effort required to manually search on various websites. Unfortunately, in this way, it becomes important only market price and thus the market become uniform. In addition companies must invest in high-performance computer networking, and security problems arise.

The cultural impact. Among the effects of using software agents, Serenko, A., Ruhi, U., and Cocoșilă, M. (2006) noted: loss of confidence, loss of practical skills, invasion of privacy, social isolation. There are users who do not have full confidence in delegating important tasks of the software. There may be a feeling of violation of privacy, because, a software agent, for act on behalf of a user needs information on its profile including personal preferences. Using the agents for communication tasks can lose touch with other human users, when they evaluate reality based on information provided by the agent - see the world through the "eyes" of the agent.

Impact on labor productivity. Using of the software agents are recommended to be made for simple or complex workloads but repetitive. This is because users are happy to solve simple work tasks, which give the feeling of success at work, as long as these tasks are not

repetitive. Releasing of these tasks, the user can become more involved in problems with really important.

7. Conclusions

In this paper we presented a brief history of the concept of software agent and a few definitions for software agents, both autonomous and intelligent, as there is currently, because no universally accepted definition. We presented some areas of the use of agents and multi-agent systems, distributed approach to solving problems, how to communicate between agents and the languages used. We then proceeded to a presentation on the general applicability of agents in e-commerce. So I tackled their operating mechanism, multi-agent systems in e-commerce, benefits, and finally, the limitations of these technologies.

Finally, I approached the impact problem of technologies based on software agents. Autonomous and rational software agents will have a real impact on the based Internet economy and on the business in the future. Such agents may make purchases on behalf of the consumer in a quantitative limit or defaults, to require information from various merchants and to filter and process information received and even sell goods or services on the Internet, actively through auctions or other virtual markets. The potential of electronic markets, broker of rational agents, intelligent, even similar in the human operator decision-making capacity, stimulate research and development in the field so that it is estimated that in the near future these technologies will become an everyday reality. Moreover, this software can be run on mobile devices and to serve the objectives of the user.

Another possible functionality could be related to software agents supply chain management and procurement process, customer relationship management, cooperation with customers, management niche markets where we have various specialized goods and services required by customers loyal but they operate fewer distributors.

The issue of free access to information and free use of computing resources on the Internet will result in gradual disappearance of the current e-business model. Most sites today, offer their content for free, and record revenue banners or other form of paid advertising. But if human users cease to visit these sites and send software agents which to collect information in automatically and thus to exploit the computing power of servers, advertising gains will disappear while the cost of operation (bandwidth, memory and computing power per server) will increase significantly. In this situation, in order to operate, organizations maintain web servers will have to ask for a sum of money in exchange for access to the system. Current micro payment systems can be developed to successfully cover these possible transactions. If this happens, on the free websites (most websites today, this is the current e-business model, on that the Web has built its popularity) will disappear.

But we must not forget that software agents provides benefits, among which we can mention: reducing transaction costs (by automatic search of information, filtering and processing, report generation, email management, network location of the lowest prices on products and services, automatic contracting B2B) and relieving the human operator of routine tasks, allowing the exploitation of human intellect in really challenging activities. Of course, to ensure the utility benefits mentioned, it is necessary to resolve the issues discussed (security issues and operation of servers).

Software agents although they have a number of limits and presents certain risks are considered as one of the most attractive technologies in the near future, becoming a necessity for companies to exploit the massive amount of information on the Internet.

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