An Intelligent Market

Possibilities of a Revolution in Supermarkets Organization Using Agent Based Systems

Eva Cipi, MSc
University "Pavaresia" Vlorë

Veronika Durmishi, MA
University "Pavaresia" Vlorë

Abstract

This work is focused on studying the possibilities of a new model in business management, integrating the best solutions of IT in the supermarket enterprises. We aim to show how an agent based system is used to manage successfully a market and why it is considered an efficient method to support the challenges of the supermarket enterprises. In a highly competitive environment, the impact of this phenomenon is visible, noting the increase of the interest for electronic systems which offer intelligent services in some activities as administration, marketing, business services, etc. We think agent based systems are the best choice as tools that can automate the analysis of the database information and locate the real useful things.

Key words: information agent, database system, software development, multi-agent-based architecture

Introduction

This work will bring another system architecture introducing information agents as tools which can automate the process of knowledge collection to gain as many advantages. The use of software agents as Database Management System components lead to database systems that may be configured and extended to support new requirements. The human experts cannot make good decisions or deducts rules for new services with the same speed that the client poses his requirements. Increase quality, reducing the costs and time of services: these are some of challenges we seek aim to overcome successfully.

First we focus here on giving present architectures that support traditional DBMS modules, and the second we will show how can integrate agent's techniques to increase the efficiency of knowledge and how to use it in the better intelligent manner possible. We will also discuss some design issues in agent-based database architecture. An application is focused on showing the results of using agents to do tasks instead of us; we discuss implementation and architectural issues.

Finally, we conclude in listing our contributions and comment on future and ongoing work.

2. Commercial Applications

As the richness and diversity of information available to us in our everyday lives has grown, so the need to manage this information has grown. The lack of effective information management tools has given rise to what is colloquially known as the information overload problem.

2.1 Information management

The potential of this resource is immediately apparent to anyone with more than the most superficial experience of using the WWW or other big information resources. But the reality is often disappointing. We can characterize the information overload problem in two ways:

Information filtering: Every day we need to be able to sort the information we need.

Information gathering: We need to be able to obtain information that meets our requirements, even if this information can only be collected from a number of different sources. One important contributing factor to information overload is almost certainly that an end user is required to constantly direct the management process.[1]

Business Process Management: Company managers make informed decisions based on a combination of judgment and information from many departments. This information is different and became more complex processing it. Using an agency in the business system of management, will be more efficient than every human operator increasing the amount of knowledge. Once the concept of knowledge management arose, the organizations became aware of the role the human capital and the knowledge it owns can play for their business.[2] Each agent represents a distinct role or department in the enterprise and is capable of providing one or more services.

3. The Research Objective

The research tries to show the relation between the agents and data bases techniques. We consider this relation very useful because we believe the agents make their job much faster and much better than every other object. The high level of efficiency comes from the big knowledge that agents accumulate. This work is divided in two phases: first we have implement the integration of information agents as simple entities that process automatically without having a history of their action, second and this future work we will integrate an intelligent agent or data mining agent in order to obtain more the results from data mining techniques. Several interesting questions arise in connection with the current research:

- Can we find a good model which become widely used in database applications?

- Can we add new services by setting new agents without compromising the processing and time?
- Can we develop a better solution if we build a new model by combining agents and data mining in database systems?

4. Active Databases or Agents?

Nowadays, extensions due to new systems requirements have created multiple extended DBMS instances, such as active database systems. Active databases and software agent systems are quite similar as both may be used on reactive applications. However, active rules are usually limited to deal with database internals, like its objects and transactions, while agents may apply to the whole system environment. However, data and transactions are continuously evolving and a DBMS initial configuration may not anymore be effective. Data that is static and consistent across sources and over time can be easily retrieved directly from the data sources. But in the above situation, where tools and applications (consumers) require time-variant data, new system components must be incorporated to perform a series of processing steps on the data to ultimately make it very useful. Consumers must maintain their own enormous databases in cases where the providers only store the data temporarily. The ideal solution is a logical value chain with different components focused on providing the services required for handling time-variant information.

When modifications are imperative, the DBMS should then be able to execute them automatically. There are more functionalities and sometime the user should be able to manage a complex system. We propose here an approach that matches agents systems and DBMSs in a feasible architecture. The agent based architecture significantly increases the level of abstraction of the system by hiding the complexity of the lower layers. In a highly competitive environment, the impact of this phenomenon is visible, noting the increase of the interest for electronic systems which offer intelligent services in some activities as administration, marketing, business services, etc. We think the agent based systems are the best choice as tools that can automate the analysis of the database information.

In such domains, an agent-based approach means that the overall problem can be partitioned into a number of smaller and simpler components, which are easier to develop and maintain, and which are specialized at solving the constituent sub problems. This decomposition allows each agent to employ the most appropriate paradigm for solving its particular problem, rather than being forced to adopt a common uniform approach that represents a compromise for the entire system, but which is not optimal for any of its subparts. The notion of an autonomous agent also provides a useful abstraction in just the same way that procedures, abstract data types, and, most recently, objects provide abstractions. They allow a software developer to

conceptualize a complex software system as a society of cooperating autonomous problem solvers. For many applications, this high-level view is simply more appropriate than the alternatives.

5. Information Agents

An information agent is a software agent that is closely tied to a source or sources of data, as opposed to being tied closely to a human user's goals (so called interface agents), or the processes involved in carrying out an arbitrary task (so called "task agents"). [6] In general such distinctions are necessarily part of a spectrum, but in this document we use the term "information agent" to denote a specific class of implemented agents with certain input/output/process behavior. Information agent is autonomous computational software entity that is especially meant for to provide a proactive resource discovery, and to offer value-added information services and products. It is capable of providing transparent access to one or many different information sources.

Managers begin to realize the importance of artificial intelligence technologies for their organizations. Knowledge is today seen as the main organizational resource and that is what intelligent systems are about: manipulating knowledge. In this paper we highlight the main reasons that an accountant can bring to his managers to emphasize this idea: intelligent systems are really needful in modern accounting.

6. Architectures for the integration of Agents and DBMS

In three integration architectures between agents and DBMSs are proposed: Layered, Integrated and Built-in. Each one of the three integration architectures has advantages and disadvantages (we omit here a detailed discussion due to space limitations). The Layered architecture is the one implemented in most existing approaches but is also the one where less functionality are supported. In the Integrated architecture the maximum agency level is obtained, as agents systems replace all (or almost all) of the DBMSs' components. However, building such an integrated system is extremely complex. The Built-in architecture enables the reuse of DBMSs' existing components. The degree of extension of DBMSs' functionalities depends on the coupling level between agents and components.

Although they use the term agent, this work does not define the agency properties. An "agent" is presented as a multi-threaded program that defines an interface between users and the DBMS. There we describe some practical aspects of agents and database integration. We will see next some proposed architectures to make agents and database systems work together.

6.1 Information agent architecture

An information agent is anything that can be viewed as perceiving its environment through sensors and acting upon that environment through effectors.[8] An information agent is one that does the things like he percepts it, analyzed them and based on this; it acts without remembering his history. A question is “how do we measure the efficiency of an agent?” Well it is very hard to make an agent to evaluate his performances. That’s why, the man is the one who establish a standard of what it means to be successful in an environment and use it to measure the performance of agents.

The used architecture puts the agent between user interface and DBMS. Users are represented by their agents in the third layer. The purpose of the agents is to bring to the user individual information and relevant messages as good as possible. To adapt its owner’s information demand the agent collects message specific relevance evaluations given by its owner.[9] The agent exchanges messages and evaluate information giving conclusions for user. In the middle of the system there is an executive agent that has the role to facilitate the communication between agents. It has also the role to evaluate the performances of other agents and to accept or to reject the registration of an agent in to the agency.

7. Case study of an agent based system in warehouse databases

For this case study we use an agent based architecture and tent to adapt it to the market place environment. This architecture uses information agents well defined to act and to do specific actions of information management. The particularity of this architecture is that we can add other agents specifying the task first. They extract and offer knowledge in real time which can be used to take advantages from good make decisions. The intelligent systems and especially agent based systems can offer the needed tools for expertise storing in a database management system. The case study will show that developing an agent based system on information management would be very useful. In a market environment of relationships between products, clients and sellers there is a continuous exchange of information where the main requirement is the guarantee of the high level of service performance.

7.1 DFD description

Here we present the Data Flow Diagram of the agent based system. The system is based on database files which take all the information. The DBMS (data software) manages data between agents and database repository statically. Studying stakeholder requirements, we have detected four services which the agents can cover successfully:

1. Expertise of selling and inventory
2. Display the changes of prizes
3. Expertise order amounts
4. Visualization of service points

We divide the module of Administrate Software in these functionalities made by developing four independent agents. Figure 4 we have designed the DFD system. The manager needs information in two modes: off line and on line. The agent activated gives services and offers suggestions on prices or making orders by detecting alert zones for every records, or makes required reports, gives supply solutions, even shows the points where human services is needed. For example, the visualization agent offer data to distribute in a network of displays taking a map of coordinates for each id_ product.

7.2 The architecture

We use the layered architecture saving the modularity of the system. We think this is the best choice of three architectures in order to develop and integrate new agents without touching the collection of autonomous agents with particular expertise. For example we can add a data mining agent. It can use data that are already integrated. There are several actions that must to be made before the information gets to the data mining agent. These actions are: data cleaning, data integration, transformation and pattern discovery. Figure 5 presents the architecture of the model.

7.3 Simulation

We consider that the project is feasible recognizing information technology in the market. We are clear that the implementation of the project will have a considerable impact in the organization. The project development needs qualified staff which supposes high costs in the use and maintenance of the system. A software product which needs great efforts for its development will increase the cost. It is necessary that organizations take a bold decision to support this project for which we guarantee a product life cycle over five years.

Parameters to be calculate:

Control_parameter=Daily_average(selling[i])*Expiry_date[i]-Today)-Inventory[i]	**(1)**
Discount = (Daily_average(Selling[i])*Expiry_date[i]-Today))/ (Inventory[i]- Daily_average(Selling[i])*Expiry_date[i]-Today)	**(2)**
Price[i] = Price[i]*(1 – Discount)	**(3)**

We consider the main risks in how successful we will integrate subsystems and should there be other costs to overcome the difficulties. Using agencies with intelligent agents, the system must be able to take necessary corrective action in time. The

agent's objectives are to monitor the system, inform logisticians and decisions makers and trigger alternative plans to take care of a fatal situation.

As we can see in figure above, the agency techniques offer results, which will be used by the user. The agents will work more quickly and efficiently if they will use knowledge instead of simple information. This kind of situations from the past are analyzed and classified from different viewpoints. This agency is very important because they help managers to identify easier and better fatal situations. The agency has an agent for each task. His objectives are: to find path analysis, association rules, sequential patterns and clusters and classification rules that could create a whole new vision of the data interpretation. This agency will have to deal with a huge number of information. That's why his agents must to be able to ex-tract that knowledge that can be useful for other agents.

8. Conclusions

At the end we give some considerations:

- This paper presents a model of database system architecture that implements benefits of using agent techniques and database management system. In the process of studying different architectures, we have chosen the layered architecture in order to raise the level of abstraction.
- We use unique method to develop independent information agents where every agent has a specific task to complete. Agents act independently nevertheless they can collaborate with users.
- This research was able to generate a final model of agent based architecture by successfully improving the efficiency of the management system. There is an agent software which detects alert zones for every records, makes required reports or suggested prices, or just gives orders and supply solutions, even shows the points that need human services.
- We developed an intelligent system for expertise storing in a database management system. The process of developing of this system take big benefits as time and quality of services.
- The reliability of the system is higher then the other systems that include the human intervention. The system can offer the needed tools for storing expertise in a database management system.
- In a market environment of relationships between products, clients, sellers, there is a continuous exchange of information where the demand is concentrated in the guarantee of the high level performance of the services We created new interactive patterns between market and client, establishing thus new trade rules as well as adopting more convenient organization structure to guarantee new fast direct relations and with a low cost.

9. Future Work

We will integrate new services using new agents in order ti increase the number of functionalities of the database system in the market and sales area.

We will work to associate a digital map of the market environment with the results of imported from the agency process management. The knowledge will be useful and inputs generating the coordinates of service points. This will require the implementation of a product network.

Bibliography

1. Weckman, G.R., Lakshminarayanan, S.: An integrated stock market forecasting model using neural networks, Int. J. Business Forecasting and Marketing Intelligence, Vol. 1, No. 1, pp(31--50), 2008
2. Aparaschivei, F.: Considerations on Accounting Intelligent Systems Importance, Informatica Economică, nr. 2 (42), pp(95--100), 2007
3. Boucké, N., Tom, H.: View composition in multiagent architectures, Int. J. Agent-Oriented Software Engineering, Vol. 2, No. 1, pp(16), 2008,
4. Weyns, D., Schelfthout, K., Holvoet, T.,Lefever, T.: Decentralized control of E'GV transportation systems', ICA A MultiA, Industry Track, pp.25--29July, 2005
5. Lungu, I., Velicanu, M., Botha, I.: Database Systems – Present and Future, Informatica Economică, vol. 13, no. 1, pp(84--100),2009
6. Wang, Y.K., Lin Y.H.: Location Aware Information Agent over WAP, Tamkang Journal of Science and Engineering, Vol. 3, No. 2, pp. 107-115 (2000)
7. Kuropka, D., Serries, Th.: Personal Information Agent, http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.3.4060
8. Bose,. R., Sugurnaran, V.: Application of Intelligent Agent Technology for Managerial Data Analysis and Mining, DBAIS, Vol. 30, No. 1,pp.79--82,
9. Winter, 1999Kalr,a, G., Steiner, D., Weather Data Warehouse: An Agent-Based Data Warehousing System, Proceedings of the 38th Hawaii International Conference on System Sciences, 0-7695-2268-8/05 IEEE, pp(2--6), 2005
10. Helmer, G.G., Wong, J.S.V., Honavar, V., Miller, L.: Intelligent Agents for Intrusion Detection, AMSP of the Ames Laboratory, U. S. Department of Energy, W-7405, pp(1--4), 2000
11. Decker, K.S, Williamson, M.: Information Agent Design Notes, The Robotic Institute, January 30, pp(1--4), 1996
12. Jennings, N. R., Wooldridge, M.: Applications of Intelligent Agents , MISC, pp(2--18), 1998

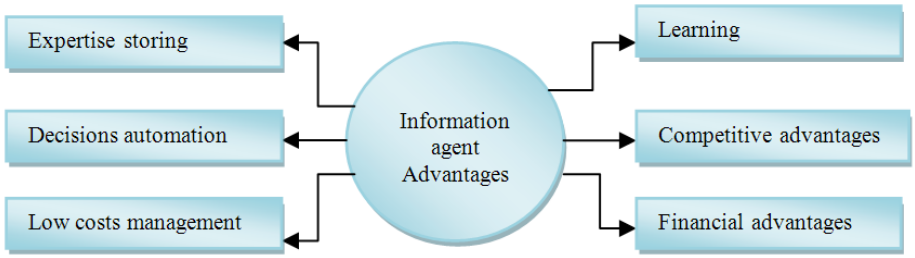

Fig. 1 Information agent utilization advantages

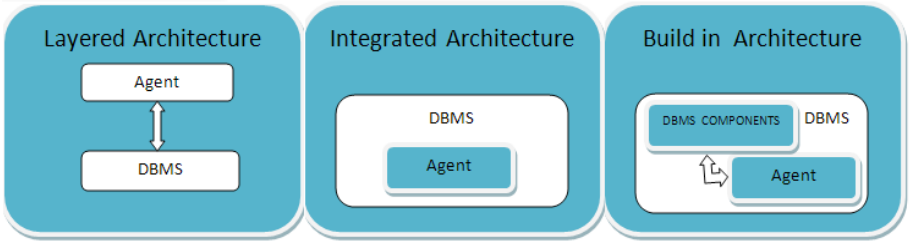

Fig. 2 Architectures for the integration of Agent Systems and DBMS

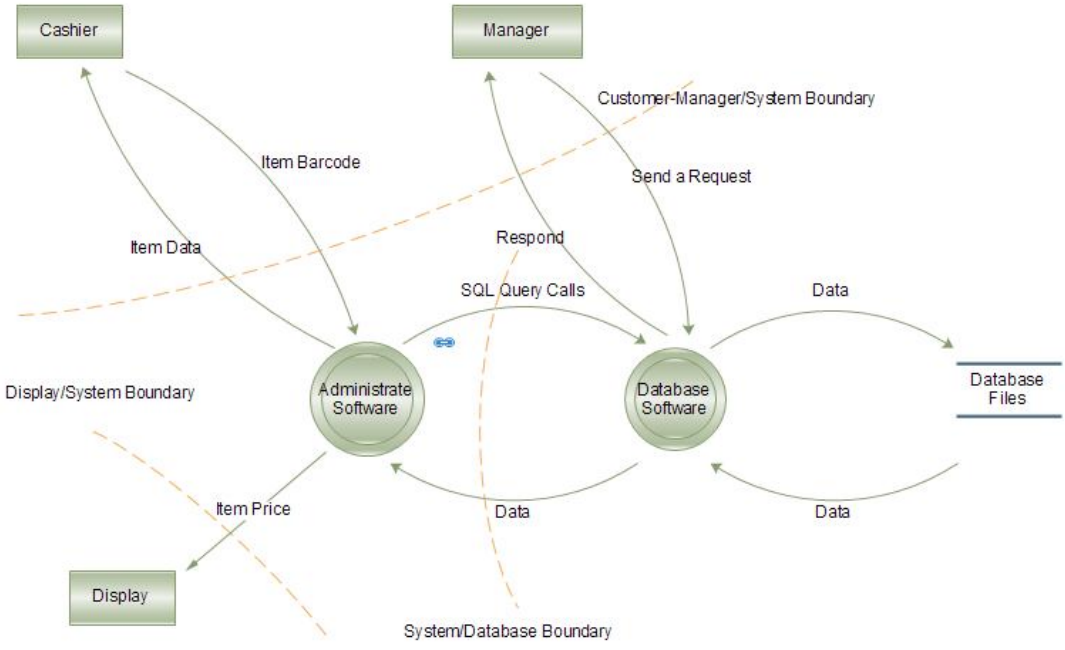

Fig. 3 Data Flow Diagram of the agent based system.

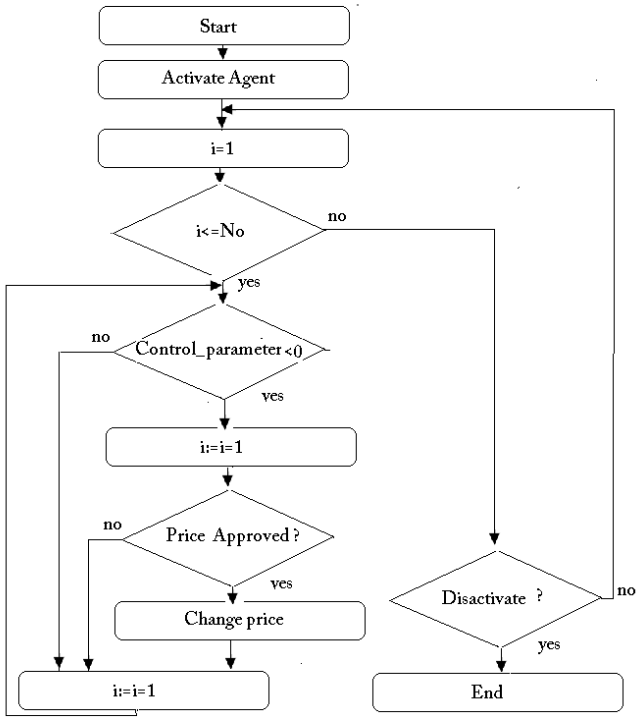

Fig. 4 Price Agent Algorithm

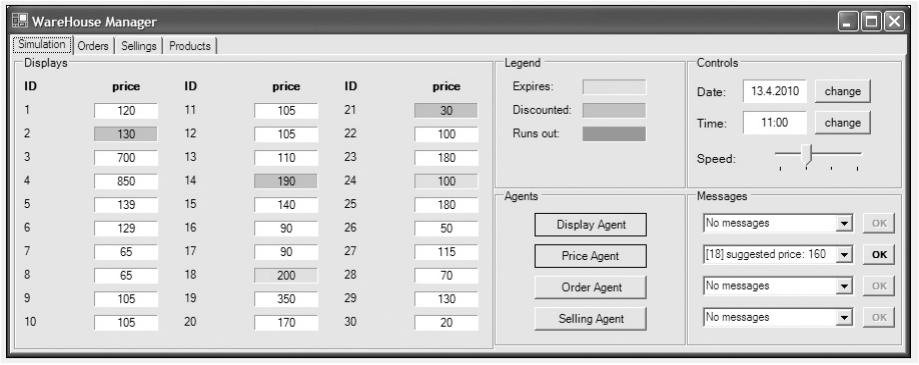

Fig. 5 Interface of the system simulation