OSETA: Obedient Software for Electronic Trading using Agent Technology

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Summary

In the early 1990s, as the Internet became more commercialized, users aimed to participate in the World Wide Web (WWW). Electronic business (E-business) rapidly expanded primarily owing to the development of new networks, protocols, software, and specifications. By conducting E-business means extensive use of information technology (IT) in general and the Internet in particular. In this paper software agent technology is proposed for E-commerce business which deals with construction material searching and purchasing. The combination of Web services and agents enhances the adaptability aspect of the system and can create highly flexible and dynamic workflow systems. An adaptive workflow suggests achieving adaptability from a process, resource and task perspectives using both agents and Web Services. The flexible and adaptive workflow systems are the demand of today's business environment which can support the different types of processes, activities and tasks. So, in that regard agents can provide a good solution to that problem. So, for that purpose agents are also introduced in the web service architecture to facilitate the E- commerce workflow process more efficient.

Key words:

Agent Technology, E-Commerce, World Wide Web, Electronic Business, Automation

1. Introduction

Gesture E-commerce can be viewed as a set of processes that support commercial activities within an information network. These activities produce information about products, events, services, suppliers, consumers, publicists, transactions, advanced search algorithms, transactional security, authentication, etc. In brief, ecommerce helps the development of a business vision, supported by information technology with the goal of enhancing efficiency within the process of trade. E-commerce has had a significant boost in its development, where technology has served as a fundamental role in its process. With the implementation of automatic facilities to deliver non-tangible goods immediately to the end-user [1], the important task now is to construct an efficient brokerage system that helps the customer find the best possible offer for his needs. Mobile agents play an important role in this process, as they represent the user in his interaction with the ever-growing marketplace.

Using mobile agents represents an important step in the development of agent systems. The possibility of working offline, thus saving network resources, is one of the main advantages. There is no need to keep a connection active while a transaction is processed [2]. Other advantages are:

- They overcome network latency
- They encapsulate protocols
- They execute asynchronously and autonomously
- They adapt dynamically and react autonomously to changes
- They are naturally heterogeneous, providing optimal conditions for seamless system integration
- They are robust and fault tolerant

A buying agent may migrate to merchant servers and execute locally functions for search, filter, negotiation and payment. In this context, the involved entities are:

- A buying agent for each merchant
- A buying agent for each client
- Objects that contain information that represents products
- Monetary values and currency [3].

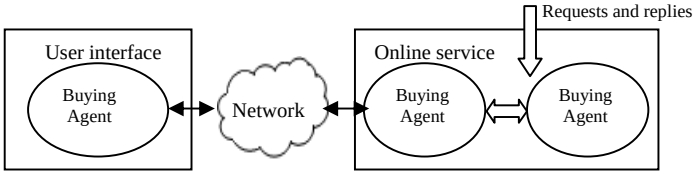

Fig. 1: Illustrates how a commercial transaction can be executed using Mobile agents

In Fig. 1 the buying agent migrates to the merchant's site where all requests and replies needed to complete a transaction will be processed. All of the required processing is performed on the merchant's site. Finally, the buying agent returns to the client's site where it will present the results [4].

E-commerce offers buyers maximum convenience. You can compare the websites of various vendors' around the clock daily prices and shop visit, without leaving their homes or in offices around the world. In some cases, consumers can immediately obtain a product or service as

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an electronic book, a music file or software downloaded from the Internet.
For sellers, offering e-commerce so as to cut Costs and expand their markets. No need to build, staff, or maintain a physical store or print and distribute the mail order catalogs. Automated order tracking cut labor costs, and whether the product or service and can be downloaded then trade and industry have no distribution costs. Purchasing the products on the Internet can be sold worldwide, give sellers the opportunity to globally market their products or services and not by limited physical location of a store. Internet technologies also permit sellers to track customer interests and preferences of our customers with the consent of their use this information needs to build a long-term relationship with the customer by customizing products and services to satisfy customers [5].
E-commerce has some disadvantages. Online furniture companies, such as most of failed because customers want to test the comfort of an expensive item like a sofa before buying. Many people consider shopping a social experience.
In the existence of these few disadvantages e-commerce opens up new Horizon versatile the modern age. It puts away time, energy, effort and money [6].

2. Related Work

2.1 E-Commerce Software for Online Shops

The Internet has made it to seconds to companies from potential customers in. The spread of the Internet means millions to the idea of online business transactions, in other words, the popular notion of e-commerce. E-commerce is now on a global level so that human world to purchase products at hundreds of anywhere from several, without leaving their homes. It also allows an entrepreneur to create a company with low cost, avoidance of costs Store set-up.
To run the E-business, business software needs, the one with the ability to do all that boring, repetitive, that one day to do it on everyone and the most important things to do always, and then E-commerce software was born. This software is a tool for all the repetitive tasks of running a company take such as keeping inventory, automated e-mail order status, credit card processing, special offers, Vouchers and much more.
There is a large market for software E-commerce today, as many people have started shopping online, and their – is currently available software in demand – according to many E-commerce [2].
The shopping cart E-commerce, E-commerce solution is designed to provide companies with reducing the maximum profit with its focus on revenue enhancement and cost. This software can be activated with companies in various sectors of businesses. Business to Customer or client to client and can effectively distinguish the types of customers. Free software updates definitely to be made available to existing customers. The software uses standard procedure such as for online transactions with credit cards and storage of personal information to the security and reliability that is critical in an online operation, the operator used.
E-commerce software asset is not only good E-commerce shopping cart software, but it can help your Internet Business with other capacity. It can be used for payment processing, web design, shop design, shipping, tax calculation and marketing can be used [7].
One of the most widespread technologies used in E-Business is software agents. Software agents also named "Agent-Mediated E-Business" [8], nowadays software agents used to support business processes and facilitate them to enter E-market places. Agents are developed and deployed to perform tasks such as monitoring, negotiation bidding, matchmaking, auctioning, transfer of goods, follow-up support.
The role of agent–based commerce is to help the comparison shopping process; they collect information from many commercial sites, filter it, and provide appropriate responses for both sellers and buyer [9].
Agents aim in providing the semantic support infrastructure for high-level elements such as business objects, business processes and workflows to accomplish a complete task, an intelligent business agent uses an incremental processing style which might include recruiting other agents in the process of task execution in a dynamic way as in fig.2 [10].

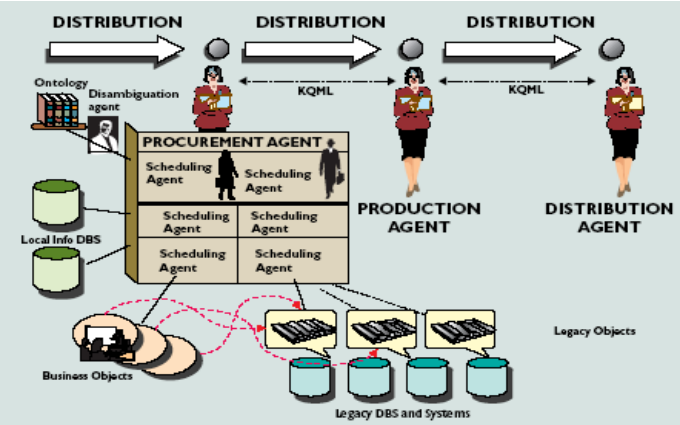


Fig. 2: Business agent in a vertical application

2.2 Basic Characteristics of E-Business Agents:

We require intelligent business agents with the following characteristics described as follows:-

1-Delegation abilities: The main idea underlying agents is that of delegation the owner or user of an agent delegates a task to the agent and the agent autonomously performs the task of side of the user. Respectively, a business agent may decompose the task and delegate parts of it to other agents, which perform the subtasks and report back to the business agent. The agent must be able to communicate with the user or other agents to receive its instructions and to provide results of its activities [11].

2- Agent communication languages and protocols: A business agent is a powerful entity; it must negotiate with other agents to gain access to other sources and capabilities. To enable the expressive communication and negotiation required and organize communications between agents, a language that contains brokering per formatives can be particularly useful (for example, the Knowledge Query and Manipulation Language (KQML)) [12]. This type of language can be used for both communication and negotiation purposes and provides the basis for developing a variety of inter agent communications protocols that enable agents to cooperate in sharing information [13].

3- Self-representation abilities: One of the most important problems is for agents to express naturally business and system aspects and combine these into a final application or implementation. This results in self-describing, dynamic, and reconfigurable agents that facilitate composition (specification and implementation) of large-scale distributed applications, by drawing business processes and functionality of existing information sources [14].

The agent approach to e-commerce provides simplicity, enhances scalability and makes interactions in a large collection of information sources become traced [15].

2.3 The Benefits of Applying Agent Technology to Business Process

The benefits of applying agent technology to business process management include:

Distributed system architecture: For the scenario concerning multiple workflow systems, agent technology provides loose coupled distributed system structure for integrating distributed business process management systems.

Automation: The inherent autonomy of software agents can fulfill activities as human substitution. Moreover, agents can start a workflow based on event trigger or more complex reaction to environment changes [16].

Interaction: Software agents enable organizations to interact with each other, normally through semantic message exchanging.

Resource management: Agents can represent resources. Task assignments and resource allocations are done through negotiation among these agents.

Reactivity: Agents react to changing circumstances and have the ability to generate alternative execution paths. This ability normally involves agent's intelligent features, such as learning. Interoperation among heterogeneous systems: Agents can be heterogeneous. The interactions rely on semantic messages for exchanging plans and service definitions. That makes interoperation more feasible than API calls [17].

Intelligent decision-making: Some high-level features of agents, such as learning, are also very helpful in workflow management, thought they are not matured techniques nowadays.

However, implementation of business process management systems using only agent technology has the following problems:

-A coordination mechanism is usually missing, which could make the systems unstable and unreliable.

-Business process optimization is difficult due to the lack of explicit definitions and representations of the business processes.

-It is not easy to track the daily operations as it is easily done in workflow management systems [18].

2.4 The Agent-Based Needs Analysis in E-Business

The Agent-based analysis showed that all E-business respondents agreed that 'click and mortar' is better then 'brick and mortar' business in maximizing profit in this global and technology era [20]. All the respondents answered positively with 14 E-business companies (70%) strongly agreed and the remaining (30%) agreed. The total of 40% of the e-business companies agreed while 60% strongly agreed that e-business really can improve relationships between suppliers and business partners. The analysis is as shown in Figure 3 below [19].

Based on the results of the evaluation of E-business environment (shown in Figure 3), it is apparent that in this global and technology era, E-business shown in 'click and mortar' organization is important in maximizing profits. The use of Internet technology in E-business makes conducting business with other businesses easier and can also improve relationships with business partners and suppliers. Also through Internet, business transactions and the order process can be done easily and faster.

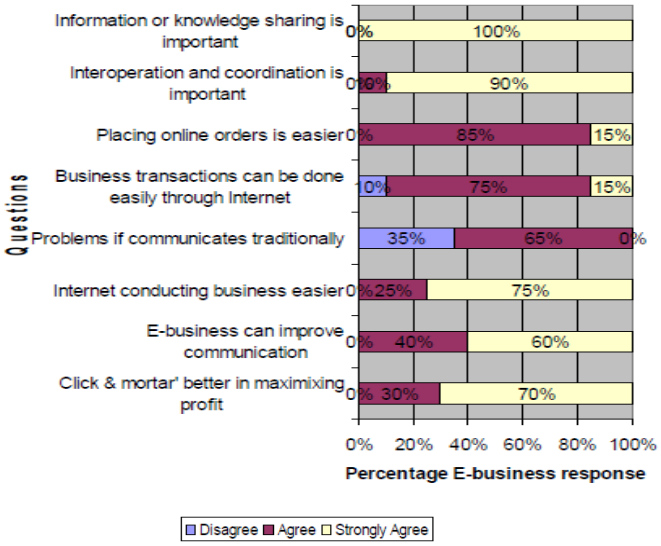


Fig.3: Analysis of E-business environment

An analysis of data findings shown in fig. 4 indicated that every E-business company expressed concern about interoperability with other E-businesses. Through e-business interoperation, such companies are able to share production schedules with suppliers and trading partners, and information on products online. As well as in local E-businesses, they are able to share resources and business processes for production, marketing and other services [19].

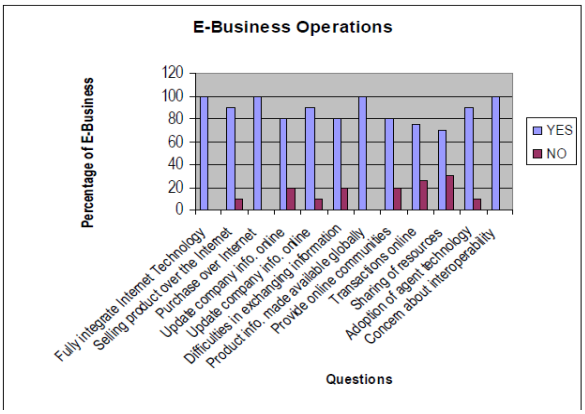


Fig. 4: Analysis of E-business operations

Beside respondents also mentioned that there are many advantages of doing E-business.
The advantages are as follows:
• Business availability on a 24-7-365 (24hours per day, 7 days a week and 365 day a year) basis,
• Faster communication with counterparts or international offices overseas,
• Better management of information, and
• Real-time accessibility to databases.

An agent can operate autonomously, communicate asynchronously and runs dynamically on different processes in different machines which support the anonymous interoperation of agents. These characteristics make agents useful for solving issues in information intensive E-business including advertising, knowledge discovery and service exchange [19].

3. OSETA

3.1 The Workflow System

Due to the rapid advancements in the technology and growing needs of E-business environment, E-businesses do need to redesign their information and process management systems. To fulfill the E-business needs due to this diversity, the suggested solution can be in the form of an adaptive workflow system.
In this E-commerce workflow, the whole process of construction material is illustrated in the figure 5. As shown in figure 5, agents and web services have been involved in this workflow. There are two main things in this workflow.
1. Agents have been involved in the web service architecture to locate and search for the construction material and to purchase it. These tasks are known to user side.
2. The tasks carried out for customers for their order fulfillment, have been introduced by agents in the processes, order capture, order process and order fulfillment by placing agents for these tasks which are capture agent, process agent and fulfillment agent.
The capture agent will be responsible for capturing the orders submitted by the customers (users, companies etc) and it will work with the order capture for that purpose. It will have information from the web service agent about material (material price information, quantity, sales tax information etc), shipping method and online credit card verification, order acceptance and notification customer.
After this process, the shipment and credit card information will be passed to the next agent which is in that case Process Agent that deals with the order process and it is determined whether about the partial shipments will be accepted or not and it is also determined that whether construction material will be allocated prior to credit card authorization, customer file is updated, inventory file is also updated. This information is then passed onto the next agent who is in that case is Order Fulfillment Agent who deals for the fulfillment of orders placed by companies, users etc.

In Order Fulfillment Process this thing is checked whether order is an internal (same region) order or external (outside region) as well as whether order will have to be fulfilled from single or multiple locations, route order (material) is checked, packing slip is printed, the order (material) is picked and packed, logistics are provided, payment is settled, order status is changed with the notification. All these activities come under Order Fulfillment Process.

For the shipment (international, local, regional shipping etc as well as integrating shipping with the third party shipping companies) and material supply, there are three more agents named Storage3 Agent, Storage2 Agent and Storage 1 Agent which have the duty to check the availability of construction material in near warehouses, providing route information and logistics information etc to the Order Fulfillment Agent to perform all these activities. The order department has all the customer files having the record of their registration details and preference etc.

The Payment System Process includes setting up merchant accounts with payment processors, integration with payment processors, required types of credit card authorization (real time), security (SSL, SET), and also it is determined whether credit card authorization will be done prior to confirming inventory availability . All these details also come under the Order Fulfillment. The Order Fulfillment sends invoices, destination details of customers to the warehouses for order fulfillment. The ware houses etc have the duty of packing etc the construction materials and they send the construction material with the invoices using suitable traveling media like bus, airplane etc.

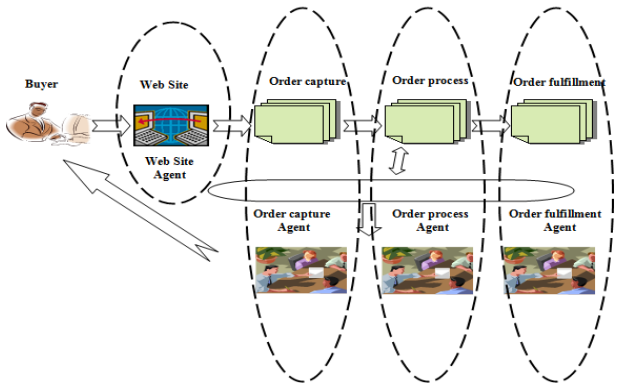


Fig. 5: Agent based extended workflow system in E-commerce

3.2 Architecture

As the rapid advancements in the technology and growing needs of E-business environment, E-businesses do need to redesign their information and process management systems. To fulfill changes and enchantments in service-oriented architectures due to different business needs demands for adaptive workflow systems, because these web services provide the computational resources to fulfill the business tasks and activities. The task focused inter actions are dynamic and flexible. According to Leymann, "the workflow construction can be analyzed as a two level programming problem and implementing these workflow activities. The application consists of computation and coordination and workflow that is defined in terms of activities and processes which are the same according to Leymann's Ideas [21]. Mostly, agents are the most important element for flexible performance of enterprise systems. Most company web sites provide only static information and do not provide facility for customer to purchase product online. The design of E-commerce needed:

1- Customer facilitates to purchase material online.
2- Provide search for construction material.
3- Update of a suppliers list.
4- Creation to a purchase order and delivery of product.

The framework in this thesis uses the agents with the web services for the finding material with the parameters in less time. therefore users , companies' personals which have assigned tasks for searching the right material in quick time with all other parameters putting in mind project budget, quality, right material information and up to date market material information. By using the agents and web services in framework can assist the user to overcome the limitations of finding the right material and selecting the right material, cost and quality attributes.

Agent based E-commerce workflow in the next diagram shows agents and web services have been involved. The mobile agents have been introduced in web services architecture to locate and search for the desired material and to purchase it. The steps carried out for customers are for their satisfaction have been introduced by:

1. agents in the process named Web Service Agent
2. order capture named capture agent
3. order process named process agent
4. order fulfillment named fulfillment agent

For these tasks they are named capture agent, process agent and fulfillment agent.

Each of the above agents will be discussed below:

- The capture agent will be responsible for capturing the orders submitted by the customers (users, companies). It will be provided with information from the web services agent (material price information, quantities, and sale tasks information), shipping method and online credit card verification, order acceptance and notification customer.

- Process agent that deals with the order process including shipments and credit card authorization, customer file details and updates.
- Order fulfillment agent which deal with fulfillment of orders needed by companies and users.

All these activities come under Order fulfillment Process. The order department has all the customer files having the credit of their registration details and preferences .The Order fulfillment sends invoices details of customers to the ware houses for order fulfillment

3.3 Analysis and Design

The work is building a 3D-Mall for shopping. In the past all of the seller make a web site selling their goods and services and it's specified for one kind of goods. But I made a 3D-mall with different kinds of goods and services if any customer wants to buy any thing instead of going to the actual mall -and how so difficult and cost time and money is now a day S- he can open his computer and open my 3D-mall from his place.

And other service which the mall is provided that the seller also can reserve a shop –place in the mall- to show his items (goods and services) in it and reserve a place for advertising in it without paying much money for the real shop (the construction and painting and finishing cost).

Type the address www.enjoy3d.webs.com, to go to the mall.

In the right the first 3 shops are:

1- Virtual art store.
2- 3D book store.
3- 3D poster store

In the left, the first 2 shops are

1- 3D T-shirt store
2- 3D toy store

Firstly, the idea of this practical work is constructing a three dimension mall containing many shops. In the mall there are some shops that have walls to show its goods as pictures on it like [virtual art shop, Poster shop-Shirt shop]and other shops have shelves to show its goods like [Bookshop, Toy shop].

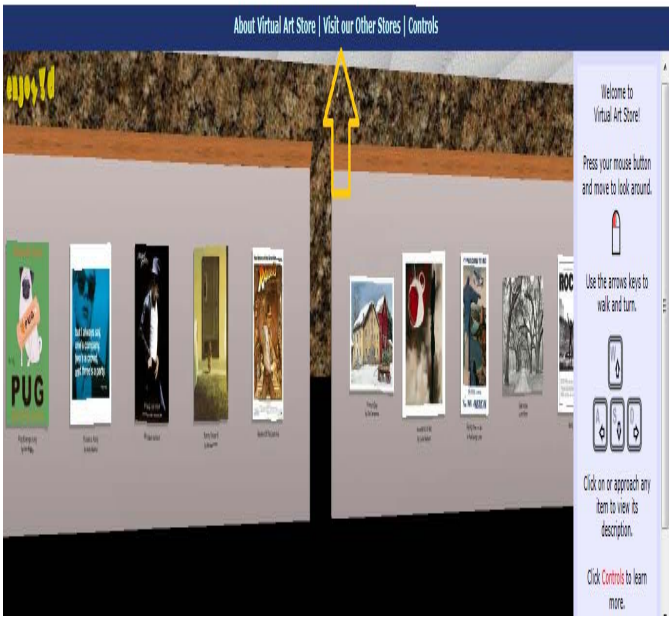
After you enter the shop you will find a flash in the right side showing you how to move in the shop .i.e. directions.

When you move through the shop you see the different goods. Here you have the ability to buy any of them, when you click in any one of the product it automatically zooms- in showing the good apparently with actual description and details on this product in the right side [it come from the real web site which sells this product]

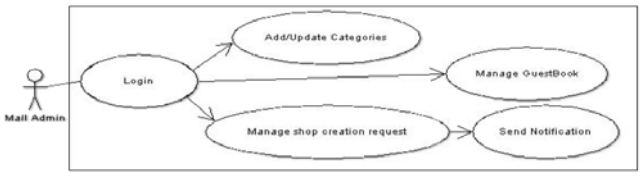
NB. I linked the shops used in this mall is connected actually to the real shop [practical] in the market using it real website notifying that changes occur in the products automatically according to market movement and sales every minute with real prices which is variable to market changes. Furthermore, there is no responsibility on my behalf. Also, there is no responsibility on me about shipment and purchase transactions.

1. First time you enter the mall it takes a few minute for buffering.
2. There is a map showing where you are in the up right side.
3. if you want to go in any floor or any shop you can go to it by clicking in the small map.

4. You begin from the middle center of the first floor in the mall passing through the shops both right and left sides.
5. All the shops in the mall and the mall it self was constructed by 3D-Max.
6. NB. As you move through each step in shop the posterior background diminishes in light and views of objects and the anterior background flourishes with new actual products controlling all light, graphics and size as each move like the actual eye scene in real life.
7. The model of the 3D mall was constructed by the 3Dmax as well as the walls used to present the goods in the shops shown.
8. The sequence of movement through each step in the shop is programmed by Action script programming language i.e. rendering easily as in real life.
9. if you are in a shop and you want to go to other one there is a tab in the top center visit our other stores

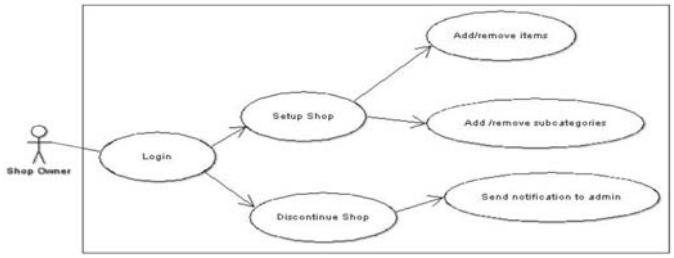


Mall Admin:



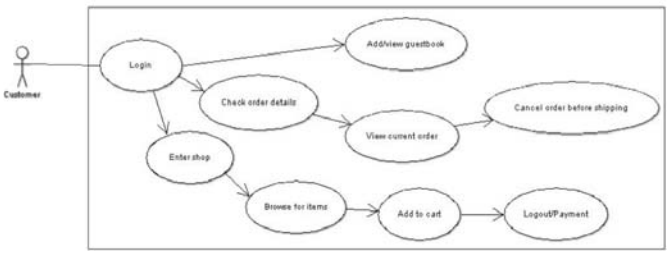
Use Case for Mall Admin

Shop Owner:



Use Case for Shop Owner

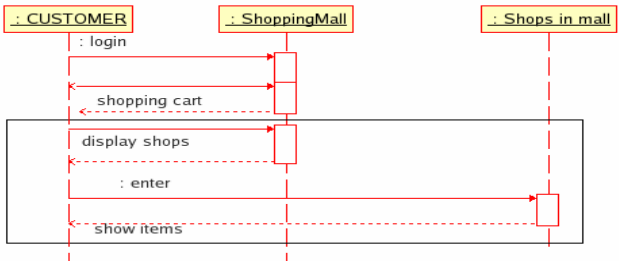
Customer:



Use Case for Customer

Sequence Diagram:

- Customer entering the mall gets authenticated and will be allocated a shopping cart. On successful authentication, he/she will be presented with the list of stores available. On entering the store he/she will be presented with the list of items available at the shop. This whole sequence has been captured by following sequence diagram.

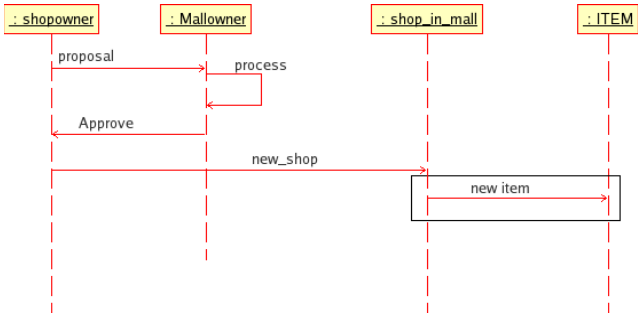


Sequence Diagram Authentication

- Customer buying a product at a shop in the mall is being captured by following sequence diagram.

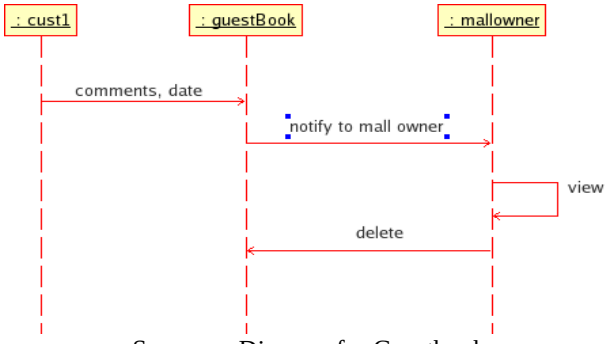
Sequence Diagram for buying a product

- ShopOwner: who is proposing for the putting a shop in the mall sends a proposal to MallOwner, MallOwner in turn approves or disapproves the proposal. This sequence has been captured in following sequence diagram.



Sequence Diagram for Shop Owner

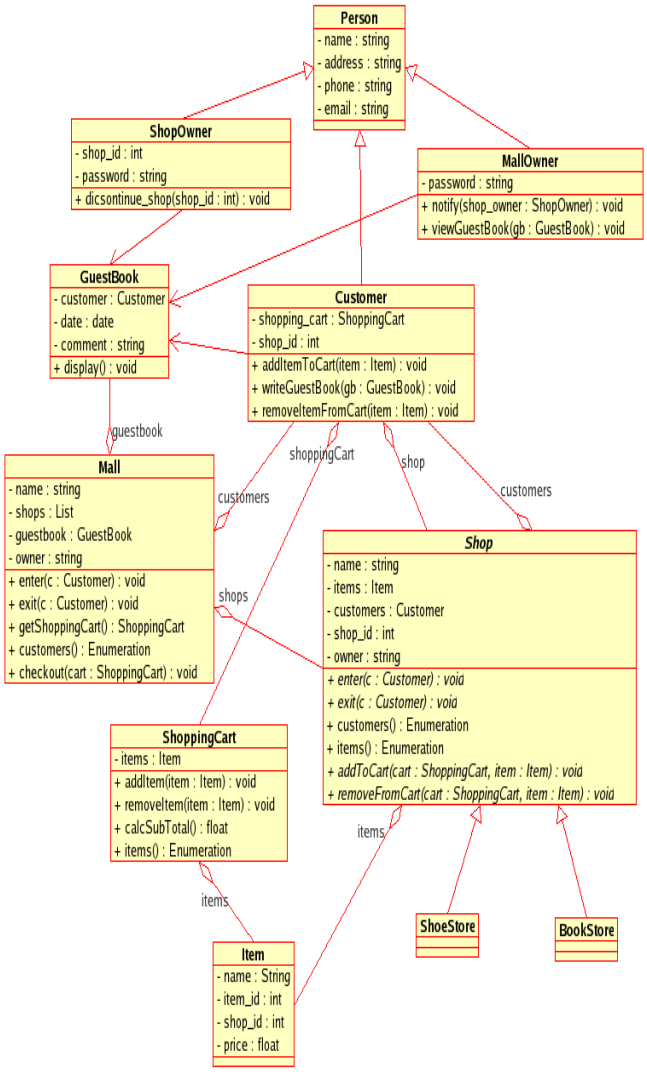
- Guestbook: Every customer visiting the mall can send his/her comments to MallOwner. This sequence has been captured in following sequence diagram.



Sequence Diagram for Guestbook

Class Diagram

Following is the class diagram for our project.



4. Previous Work

- J. Calmet 2004 sketched a model for Agent Oriented Abstraction (AOA) that shows the basic concepts presented in Object Oriented Programming (OOP). Agents are presented as objects and via their knowledge contents they are organized into compartments that gather classes. this model provides the meaning of the concept of Agent Oriented Abstraction that possibly formulize a specialized AOA in the language of category theory , the investigation of the formal specification of AOA model with algebra approved the challenging project [22].
- N. Jennings 2000 showed that agent based computing is a significantly important approach to software engineering. It is related to developing software in truly open systems. It discussed the tools used for accomplishing complexity in software. It also discussed the drawbacks of agent based approach that should be solved to maintain flexibility and development of software systems using autonomous agents in a dynamic environment [15].
- C. Pincemaille 2008 showed the importance of agent technology in distributed system as internet. It discusses the implementation technology and the languages used as java and Telescript. For the technologies the development of JAVA and CORBA combined with development of frameworks make agent technology grow easily [12].
- F. Al-Shrouf 2009 presented an approach for deriving application patterns for business engineering. The agent based system engineering allows the re-engineering of business processes and benefits from agent and object design patterns. These patterns support selling/buying based business processes. The development of agent –based patterns is still in early stages of development. The facilitator design pattern is used to support selling/buying in E-commerce processes [23].
- C. Badica 2006 explained agent systems in E-commerce which described an agent based model E-commerce system that utilizes rule-based approach for price negotiations. Concurrently the proposed system being implemented and extended using windows and Linux workstations. The price negotiation used is linked to the English auction using the JESS module [4].

5. Conclusion

The main focus of this paper is to optimize E-business outcomes in one to many transactions. The intelligent agent technology is growing, as there are many opportunities (business and technological) techniques should consequently improve. This information provides the important references for the agents while they generate a new offer. The significance of the results from the experimental work has proven that the adaptive nature of agents can increase the fitness of these autonomies agents in the dynamic E-market.

Adaptive agent workflow framework facilitates customer to overview cost, time and business value also by introducing the agents in the E-commerce processes make the working of processes more accurate, persistent, backtracking in case of data loss through agents which are coupled with the process etc. The structure of adaptive workflow framework illustrates that agent based methodology facilitates the exiting work flow in E-commerce domain. The reasons for this is principles on which agent methodology is based i.e. flexibility to adapt to the environment and alter the changes that occur in work flow.

Further it facilitates the customers to perform search and purchase. Web services are integrated with agents to provide refined and better search, which can be helpful for customers in purchasing the item.

Besides although the flexibility of the agent interactions there are many advantages which are discussed below:

Agent in this system provides modularity in terms of representing information and information sources; it also allows extensibility, flexibility and efficiency in terms of minimizing the overall time for a given query. Mobile agents characterize with scalability which allows people to explore many source of information. Agents can be instructed to execute tasks at specific times or automatically and react in response to system events. It also allows task orientation and adaptively to maximize the use of mobile agent by customers.

Although agent technology has an important role in the development of computing applications it should be noted that the nature of agent leads to number of problems, common to all agent-based applications:

No it may not be adequate for domains in which global constraints have to be maintained, in domains where a real-time response must be guaranteed, or in domains in which overall system controller. An agent-based solution deadlocks must be avoided.

No global perspective. An agent's actions are, by agent's local state. However, almost any realistic agent system, complete global knowledge is not possible; this mean that agents make globally sub-optimal decisions.

Trust and delegation. For customers to be comfortable with the idea of delegating tasks to agents, they must first trust them. Both individuals and organizations will thus need to become more confident and accustomed with the autonomous software components, if they are to become widely used.

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