Research on E-business Intelligent Examination System
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Abstract
This paper presents a study on the examination of E-business intelligent systems as researched by Xin Jin, a student at the Central University of Finance & Economics in Beijing, China. The paper shows how one can analyze or examine the Intelligent E-business system when being used by the user. The paper discusses the design and development of such an intelligent E-business system. The client server architecture is used to explain the two major parts which are a teacher site and a student site. The person examining the system is given a web browser GUI through which he can feed his answers. This is referred to as the Student site. The Teacher site has been equipped with three options such as paper management, new paper creation and a paper scoring option. The paper discusses about the system architecture, simulation environment and solutions to some key questions.

1. Introduction
The fast evolving technology has made E-business a very fast growing sector. With the Information Technology supporting the E-business the range of its applications has increased tremendously over the recent years. In today’s technological world E-business plays a very important role also in boosting the economy of a country. E-business systems have more security risks than the traditional Business systems, hence it is very important that these E-business systems are constantly monitored and examined. Examining these E-business systems makes sure that the system is also consistent.

This paper discusses about the development of an Examination System for E-business Application Operation (ESBAO) which is a part of E-business education and training software system supported by Shanghai Information Office. This system examines the ability of the users when using the E-business system. This system has the following two characteristics.

a) Checking the ability of the users based on E-business workflow
The users are given marks based on how they select the options to complete a particular task. There could be more than one way to complete the task and the ESBAO system scores the users based on how the task was started and weather the goal was reached or not. Searching for a Product can be used as an example in this case.

b) Intelligence of the ESBAO system
The intelligence of the ESBAO system depends upon the Teachers site. It depends upon how the Teachers site has prepared the paper using the two subsystems which are the Paper Building Subsystem and the Paper Scoring Subsystem. Here the Teacher could manually create the paper using the GUI or the Building Paper Agent (BPA) which automatically builds the paper could be used. The teacher uses the GUI of the Scoring Paper Engine to mark the examination and the results are stored in the database.

2. System Architecture
The ESBAO uses the following technologies to design and implement the E-business simulation environment:
- XML Technology
- Component Technology
The system uses two components, the client component and the server component. The client component is also called the Student site and the server component is also called the Teacher site. A GUI (Graphical User Interface) embedded in a web browser is provided by the Student site. This GUI is used by the examinee to participate in the simulation of the e-business environment and to answer the paper set by the Teacher site. The Teacher site has three main components: Paper Management, Paper Building and Paper Scoring. The Paper management manages the paper database. The Paper Building system helps in creating a new paper and the Paper Scoring helps in scoring the paper answered by the examinee. There are also additional components like Scoring Paper Generator which generates standard answers for the Paper created and an Answer generator which generates the answers given by the examinee and a Monitor which monitors the operations done by the examinee while attending the simulation.

The below figure shows the System Architecture of the ESBAO system

System Architecture of ESBAO system

The Teacher is in control of the Paper Creator through two options. The Teacher can use either the Building Paper Agent or the Paper Database to create the examination paper. The Teacher can use
the manual procedure to create a new paper or just start up the Building Paper Agent to automatically create a paper. After the paper has been created with either one of the options the answers are automatically generated and stored in the Database. The questions are then available for the Examinee. In order to take part in the Exam the Examinee is given a E-business simulation environment in which he can carry out the various operations to take part in the test. The Monitor component does the job of monitoring all the actions performed by the Examinee. There are also Operational Recorders which assist in recording all the operations that are carried out by the Examinee. These inputs are then given to the Answer Generators which collect all the answers from the Examinee and pass it on to the Scoring Paper Generator Component. The Scoring Paper Generator when started, automatically compares the answers of the Examinees with the standard answers available in the Database and gives out the scores.

3. E-Business system Simulation Environment

The E-Business system Simulation Environment supports in running the entire system and is an important part of the ESBAO system.

3.1. Introduction to E-Business Environment

The activities of E-Business usually consist of the following:
- Identifying requirements
- Brokering products
- Brokering Vendors
- Negotiating deals
- Making purchases or payment transactions

These above mentioned activities are at present carried out by the human beings. However in the future we will see them being carried out by automated software called Software agents. Software agents customized, partially automatic driven and continuously running. They are generally used in place of human beings so that time consuming tasks can be automated and carried out simultaneously.

E-Business is a very user friendly environment. Services based on demand need to be created as and when required. These services need to be maintained only up to a particular duration of time. This nature of E-business is called Dynamic nature which means E-business is very flexible. This nature of E-business also helps in multi-agent cooperation based on dynamic ontology. This means that the concepts and rules under which the agents cooperate with each other vary between different domains at different times. A stand format should be provided so that these agents communicate and exchange information readily. This format should also be common for both the agent communication and the e-business data. XML is used for the designing of the E-business environment as it is becoming a standard for data exchange on the internet.

3.2. Dynamic Agent

A Dynamic agent does not have predefined activities defined in it. The activities can be defined as and when they are required by the environment. A dynamic –agent has two parts. A fixed part which contains light weight, built in management facilities for distributed communication, object storage and
resource management. A dynamic-agent has objects such as data, knowledge and programs, which form the changeable part. The agents are similar when they are created and are modified according to the need by loading java classes which represent data, knowledge and application programs.

Dynamic-agents can perform the following through messaging:

- Can expose their knowledge, abilities and intentions
- Present requests and exchange objects
- Move to the appropriate location for high bandwidth conservation
- Can manage their own resources across actions
- Supports dynamic construction, modification and movement
- Participate in multiple applications and dynamically formed partnerships

With the above features the Dynamic-agents fit very well into the E-Business environment.

3.3. XML Messaging

XML is quickly becoming the standard data format for Internet technology. It is also very popular for the broader range of component technologies. XML is a useful way to introduce structure into the body of HTTP requests. As components increasingly are designed to be accessed over the Internet, it becomes more and more important that component technologies have the openness, and use the protocols, that make up Internet infrastructure. For this reason, XML messaging is emerging as an important component technology. Agents communicate with each other by sending messages. Agents use message interpreters to exchange ontologies. Dynamic agents send and receive messages through XML encoded messages.

3.4. Workflow Engine

In the E-Business environment the flow control for the business process automation is provided by the workflow engine. Multilevel collaborative and transactional tasks are often involved by Business processes. At the leaf level a task is performed by a role. A user or a program helps fill a role at runtime.

The relationship between the workflow and the agent cooperation for supporting E-business should be well understood. The mechanisms for plugging the workflow in agent cooperation and plugging agent cooperation in tasks of business processes have been developed. Dynamic work flow service is provisioning is supported to allow workflow servers to be built as and when required.

4. System Design and Implementation Essentials

Under the E-business simulation environment the operations performed by the examinee and the results can be monitored. The primary goal of designing of the E-business simulation environment is to test the ability of the E-business operation.

It is done as follows:

- Capturing and analyzing the operations
- Concurrency of many operations
• Automatically Building paper and scoring paper
• Capturing and analyzing dynamic workflow

4.1. Capturing and analyzing the operations

Most of the methods of recording the operation procedures are related to the structure of the E-business simulation environment. When it is a client / server architecture, the ESBAO system can setup the Monitor program in both the client and the server. However when it is a Browser / server architecture the monitor program can be set only in the server to trace the operations of the client. It is also very important to define in advance which operations the Monitor program needs to monitor when the Monitor program is setup in the server. This can be solved by adding triggers to the Monitor for performing operations like add, delete and update. Log records can also be added to capture operations since we are using a Server component.

4.2. Concurrency of many operations

During the past it was very difficult to maintain concurrency but this is not the case with present systems, concurrency can be easily implemented. Since many users will be taking part in the exam at the same time the concurrency issues that occur can be as follows

• Concurrency with resources
• Concurrency with applications
• Concurrency with workflows

The below methods can be adopted to resolve the above concurrencies

**Adopt memory database and data view**

In this method we allow the data of the user to reside in a temporary memory and not in the database. So the user is always working with the temporary memory as long as his operations are being carried out. Only the final results are written to the database thus avoiding operation concurrences.

**Isolate the public data and private data**

In this method the system creates backups of the data and resources used by the Examinee. Hence different examinees would be using different backups, thereby avoiding concurrency.

**Using programs to simulate many people cooperation operation**

The system adds dummy examinees with the help of programs. Such a method is used in case of a contest where there are not sufficient contestants available.

**Data restore**

The system provides facilities to restore the data to its original state once the examination has been completed so that this data could be reused once again.

4.3. Automatically managing papers and scoring papers

Managing papers using the Paper Database is very efficient because all the questions will be tested for correctness. The Teacher can use the Paper Creator to build questions and also set the
monitoring parameters. The scoring would be judged based on these parameters. The ESBAO system not only contains automatic paper checking by comparing XML documents but also contains added parameters like personality requirement and evaluating guidelines which make the automatic scoring more efficient. It is possible in the E-business simulation environment to have more than one method of answering the questions by the examinee. In such a situation it would be difficult for the system to judge which answer is the correct one. In order to take care of such situations Monitors are defined with operation procedures and the integrated workflows are divided into many sub objects. Hence the scoring done using these Monitor parameters and the sub divided workflows gives a better result.

4.4. Capturing and Analyzing Dynamic workflow

There are some dynamic business activities in E-business environment and it is difficult to capture these dynamic business workflows. The different E-business activities are to be linked so that they form the E-business workflow chain based on the E-business operation activities. The basic activity in the dynamic work flow is the request and response. An example of such an activity is purchasing activity, which involves activities between the buyer and the seller. In order to capture these activities in the E-business environment we use the Web Services Technology. These web services use XML based standards like:

- Simple Object Access Protocol (SOAP)
- Universal Description, Discovery, and Integration (UDDI)
- Web Services Description Language (WSDL)
- And several other protocols which help application communication

SOAP which is an XML based protocol for exchanging information in a decentralized, distributed environment.
UDDI is an XML based specification for registering businesses and web services.
WSDL helps developers utilize the syntax of a Web Service.

5. Paper Database based on Ontology

In computer science and information science, ontology formally represents knowledge as a set of concepts within a domain, and the relationships between those concepts. It can be used to reason about the entities within that domain and may be used to describe the domain.

In theory, ontology is a "formal, explicit specification of a shared conceptualization". An ontology renders shared vocabulary and taxonomy which models a domain with the definition of objects and/or concepts and their properties and relations.

Ontologies are the structural frameworks for organizing information and are used in artificial intelligence, the Semantic Web, systems engineering, software engineering, biomedical informatics, library science, enterprise bookmarking, and information architecture as a form of knowledge representation about the world or some part of it. The creation of domain ontologies is also fundamental to the definition and use of an enterprise architecture framework.
5.1. Paper Ontology with XML / XML Schemas

XML (Extensible Markup Language), is a good method to describe ontologies in a distributed environment. With the help of application specific tags like `<QUANTITY>` or `<SPEED>` XML allows the definition of customized markup languages. Having a human readable and well defined syntax are the advantages of XML. Although XML allows the specification of user defined tags, it cannot provide the semantics required of ontology. Also the inheritance mechanism is missing is XML. In order to define Ontologies relations between concepts, hierarchies of concepts is required. XML schemas provide data types as well as relationships between elements and support namespaces.

Fig. below shows the paper ontology with XML Schema.

```
<PAPER>
  <PAPER_NO></PAPER_NO>  //Paper ID
  <PAPER_DATE></PAPER_DATE>  //Testing Date
  <TEST EX_ID="" >
    <T_TITLE> </T_TITLE>  //The Question
    <T_SCORE> </T_SCORE>  //Score Value
    <T_QUESTION  T_ID="1"/>//The Selective Item
    <T_QUESTION>
      <T_QUESTION  T_ID="2"></T_QUESTION>
    . . . . .
  </T_QUESTION>
  <T_KEY> </T_KEY>//The Correct Answer
  </TEST>
</PAPER>
```

The Paper Ontology with xml/xml schema

5.2. Ontology and Database Schemas

It is often difficult to identify and Ontology from a Database Schema as they are very closely related. It is especially difficult to identify when schemas are represented by using a semantic data model. The main difference lies in the purpose of using them. While Ontology defines the meaning of the terms used in some domain, schema is developed to model some data. Semantics and data structures are important and hence both schemas and ontologies play key roles in heterogeneous information integration. A Schema needs an associated formal ontology in order to make the semantics of the resource clear. Programs that exploit semantics can be designed when the meaning of data and schema is made explicit using an ontology.

5.3. Entity correspondence

In E-business environments sometimes data is scattered across heterogeneous distributed systems. In such situations Ontologies are used so that the consumer can access as much data as possible and integrate it. Integrating information from a supplier’s product catalogue with customer reviews produced independently can be taken as an example in such a case.

The relation between entities across resources must be established in order to gather all the information relevant to entity. For example, the academic and criminal data of a person are stored in different data resources.
6. Key Technologies for System Implementation

The following technologies are adopted to implement the ESBAO system.
- Component technology
- Ontology and XML technology
- Web Services
- Database technology
- Agent technology

Conclusion

The research shows how the E-business simulation environment can be used to examine the intelligence of the ESBAO system. The Teacher component creates the paper which is answered by the Examinee in the E-business simulation environment. The operations of the Examinee are closely monitored during this process. The responses given by the examinee are compared with the answers generated by the system and a final score is given by the system. The system includes both manual and automation of the various components.

References

Xin Jin, Research on E-business Intelligent Examination System, (School of Information Central University of Finance & Economics, Beijing, 100081, China)

Wikipedia