A New Flexible Method for Workflow Management

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Abstract- **The change capability of information flow in organizations is a major request that is required from IT masters by managers. In this paper we develop a novel method for achieving this goal. This method uses UML activity and sequence diagrams in front-end section, and tree structure of XML language in back-end section. Extended UML diagrams provide an easy designing mode for managers that they can easily design flows and do their favorite changes. In the back-end or business process, graphical diagrams convert to XML trees and thus the process of them can do flexible because the nature of XML language makes a hierarchical tree using nested tags. Using this method can solve the old problem of managers that want a fast, flexible system for supporting policy changes in organizations.**

Keywords- **workflow management systems, information systems, uml modeling language, XML language**

I. INTRODUCTION

Various operations in an organization are always done under a designed policy. For instance the documents flow in organizations is determined by the policy of workflow of organizations and existing dynamic policies. These policies may change sometimes for various reasons [1]. This kind of changes in organizational policies and the process of workflow in organizations have always been a headache for managers of organizations. Because teaching a new policy to employees and then demanding obedience of them is a hard and time-taking job, and probably there will be some resistances for it [1]. Therefore one of the needs of the organizations managers is the ability of simply changing the policies and performing them instantly in organization, in which all of the employees have to operate these new policies.

By mechanizing the systems and using organizations of computer systems of workflow management, the employees have to obey of the organizational policy in doing their commitments and interchanging with other relevant parts[1],But still there is a main problem, these kind of systems either are not that much flexible that we could change the process of workflow easily or totally is impossible to make changes in them, But there is a need to have a special skill here, for example the ability of writing codes in an special language or interpreting policies with special sentences(for suitable interpretation by the algorithm of interpreting human language)[2,1]. On the other word the major problem here is that the systems are not flexible and dynamic or we can say the dissimilarity between human language and machine language and also the lack of a compatible interpreter is an important problem now [2].

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In this paper an approach is suggested and explained in which by operating it as a middleware in informatics systems, workflow management will become flexible and make changes will be possible easily in organizational policies for the managers without any need to a special skill in this case.

In this method we have an expansion of modeling UML language as an apprehensible language between human and machine and also we used XML language for its dendriform characteristics and its feasibility of logical processing.

The framework of the paper is: part 2 is about workflow management systems, conceptions and expressions and its reference model and its shortage and problems. In part 3 we will explain general suggested process for making workflow flexible and the reasons of choosing these methods for it. At the end of this part the suggested method will be expressed completely. In part 4 we will evaluate and compare this method with other existing methods. Finally, in part 5 we have a summation and an overlook of future.

II. WORKFLOW MANAGEMENT

Conceptions and Definitions

Workflow management systems are one of the main parts of each informatics organization. According to definition, automation of a commercial process which completely or partly during it, documentaries information or work in based on a series of defined rules interchange between features of system is called a workflow management system[3].Automation workflow in a system will remove those different errors that users may make during work processing[2].

Workflow management includes five major aspects, in which each management system must be able to support all of them. These aspects are the following:

- *Functional Aspect: Determining "must" and "must not" of a management system.*
- *Behavioral Aspect: Expressing an outlook of processing acts and the order of operating these acts.*

- *Informational Aspect: Analyzing data and flowing of data in system and providing correct data in an appropriate time.*
- *Operational Aspect: Determining condition of operating workflow process, approaches and needed tools.*
- *Organizational Aspect: Fulfitting organizational requirements in management system and determined some liable people for directing management system in different parts.*

There is another division of workflow management systems. The system is divided to operational model and enunciatively model [5]. Control affairs of workflow must be completely posted in part of relevant expressing commerce. And in part of relevant processing commerce have applicability.

In above suggested method we have applied of UML language. This language has been used to explaining of software systems in an exact way, before operating for the reason of make assurance of operating system in a correct style [3]. The characteristics of this language let us to use of its improved parts for modeling of workflow process [3]. In addition we have advantaged of XML language for using informatics aspects and workflow management system operational. XML language is also an expressive language for organizing information to a suitable dendriform format [5]. So we have used XML language for its trait and also since the subject of this article is part of a big informatics system project which is a text-acquainted to XML language that is common between middlewares.

Reference Model of Workflow Management System

According to various existing aspects in workflow process, the reference model in modular style by OSI organization has been offered [6]. Fig. 1 displays this reference model.
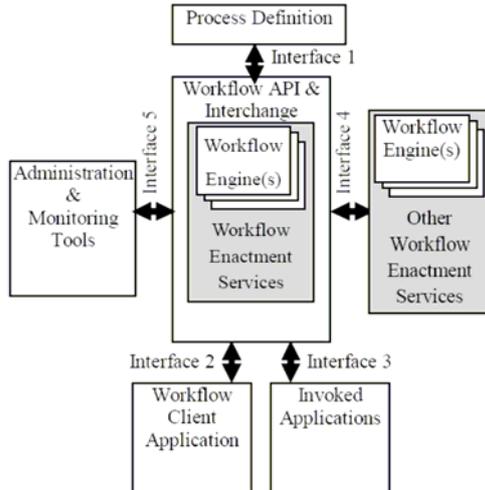
Fig. 1 Workflow reference model

- *Tool of Process Definition: System procedures should be defined in a way in system and management system based on these definitions operates. This part depends on functional and behavioral aspects of system.*

- *Management and Monitoring Tools: Every workflow management system must have some tools for supervising correction of operational process. This part is also related to organizational aspect of system.*

- *Start up Services of Workflow: The main operation of workflow is done by the facilities of this part. Informational and operational aspects of system are related to this part.*

- *Applications and Invoked Applications: Start up services of workflow for doing some parts of their undertakings may have to apply of some outer application. This part is also related to management system of operational aspect.*

Related Works and Existing Methods

Studying and researching in field of mechanization and automation of workflow management systems that have done until now, offer the following methods for operating different parts of system:

- *WFLM's XPDL: Management collation workflow organization has developed a language based on XML which is called XML process definition. In this system users express the control flow by XPDL language. The general purpose in this system is producing an independent and exhaustive language different kind of workflows. The most important imperfection of this language is its high complexity in expression for the users.*

- *YAWL (Yet Another Workflow Language): This language is just designed for workflow management systems and is based on workflow patterns. This language is the most perfect language for expressing different kinds of workflow processes and has a simple enunciative model [8].*

- *JSRO207 (process definition for java): It is a language for automation of organizational processes which part of it is related to workflow processes. This method is just able to set up in documents management systems based on JAVA and J2EE [9].*

- *UML: As it mentioned before modeling language of OMG organization defines 9 different diagrams for modeling and designing software systems. In some done projects it is used of some of these UML charts either genuinely or just with a little change for workflow process management. This model is the most perfect and simplest for enunciative purposes and fulfitting functional, behavioral, organizational aspects. the main weak point of this method is the correct choice of symbols, charts and needed pattern from UML for expressing workflow in which managers of organization are not suppose to learn all of the UML charts and details of work.*

- *Petri Networks: Adam Petri in 1960 invented Petri networks and until now they are widely used for modeling, analyzing and simulating dynamic systems with synchron and irregular activities. This method includes navigator graphs and shows states and transactions. It has more visual complications relative to UML models.*

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Duo to it had designed for nondeterministic models and unpredictable reflexes; it isn't so suitable for workflow process that is a routine and regular process.

Problems and Requirements

In spite of done efforts, none of above methods can completely provide managers' requirements in automatic workflow process, high flexibility and system simplicity all together. Some of problems of these methods listed below:

- *Too Formal in Modeling: in XPDL and JSR it's too hard to present workflow model in front-end section and it needs formal and special modeling that is not acceptable for systems' managers.*

- *Too Informal in Implementing: Some methods overcome first problem and provide informal and simple presentation in modeling, but still they have weakness in converting informal models to technical implementations with ability of processing on computer systems.*

In addition of these problems, some of managers' requirements are still remained. Such as:

- *Ability of changing the policies*

- *Simplicity of system*

- *Fast execution of changed policies*

For eliminating these problems, we designed a new dynamic workflow management system that is explained below.

III. DYNAMIC WORKFLOW MANAGEMENT – PROPOSED METHOD

In this section we will explain proposed method and its advantages in detail.

Workflow as a Context

As implicated, this paper is a section of bigger project of designing a context aware middleware for document management systems. This middleware should sense and process contexts of environment and then act awarely. Workflow is a one of important contexts of document management systems,

whereas the main purpose of context aware systems is support users in their tasks by aware functions.

Main Process of Proposed Method

Proposed method should conquest incompetence of other methods and compliance remained requirements. Such as:

- *Simplicity of modeling language and ability of support all workflow's templates*

- *Capability of processing language and ability of converting modeling language to it*

- *Ability of execution changes in systems*

- *Flexibility of system and ability of execution changes in right time*

- *Ability of being used in current information systems with least changes an cost*

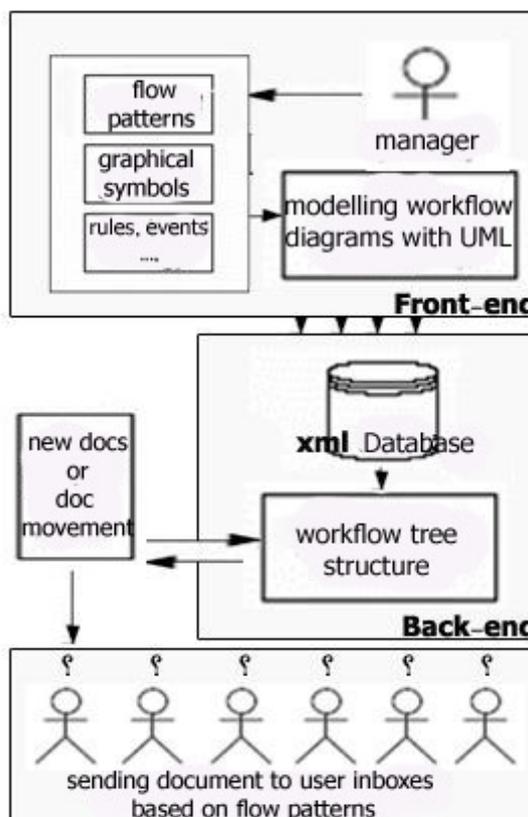Fig. 2 shows main schema of proposed method for workflow management in information systems.

Fig. 2 Main schema of proposed method

The reasons of using UML as front-end section

The most important reasons are:

- *The UML is a standard language for modeling and graphical symbols are very match to human mind [3].*
- *The UML is the software modeling language and a workflow system can consider as a software system [12].*
- *The symbols in UML are designed in the way that can convert to implementation code, simpler than other symbols.*

The reasons of using XML as back-end section

- *Hierarchical structure of XML language and ability to use tree parsing methods in this language [5].*
- *The ability of tag definition on demand, based on the usage of codes [5].*

MAIN PROCESS IN PROPOSED METHOD

1) *Front-End Section:* The visual modeling section of system, uses some graphical symbols that combine together in order to express special contexts. In addition, there are some common workflow patterns that this graphical section must support using of them. The symbols that we use in this section are:

- *Narrow line*
- *If node*
- *OR node*
- *AND node*
- *Process node*
- *Chaining node*
- *Delay node*
- *Start and stop node*
- *Rule node*

The pattern that support in this section, are common and necessary patterns for modeling and showing workflows in organizations. Such patterns are:

- *Pattern 1 (Sequence): Two or more activities in a workflow type are processed in the order, in which they were defined*
- *Pattern 2 (Parallel split): This pattern defines a point in a process which is split into several threads of control, all executed in parallel, whereas the order in which they are processed is not defined*
- *Pattern 3 (Synchronization): A point where multiple parallel sub processes converge into one thread, whereas each incoming branch is executed only once*
- *Pattern 4 (Exclusive choice): It defines a point in the process where a certain condition based on a decision in the flow is taken*
- *Pattern 5 (Multi-Choice): This pattern defines a point in the workflow process, where based on a decision a number of branches can be chosen*
- *Pattern 6 (Synchronizing Merge): This pattern defines a point in the process execution, where several branches merge into a single one. If more than one branch is active, the merge synchronizes these branches (waits for all the active ones)*
- *Pattern 7 (Multi-Merge): A point where two or more branches converge without synchronization, but with multiple execution of the following activity if more than one branch is active*

Fig. 3 shows some of these patterns.

1) Back-end section

The first step in this section is designing tree structural tags for demonstrating workflow patterns. As mention before, a mail advantage of XML is the ability to tag definition in it. The suitable architecture is shown in Fig. 4.
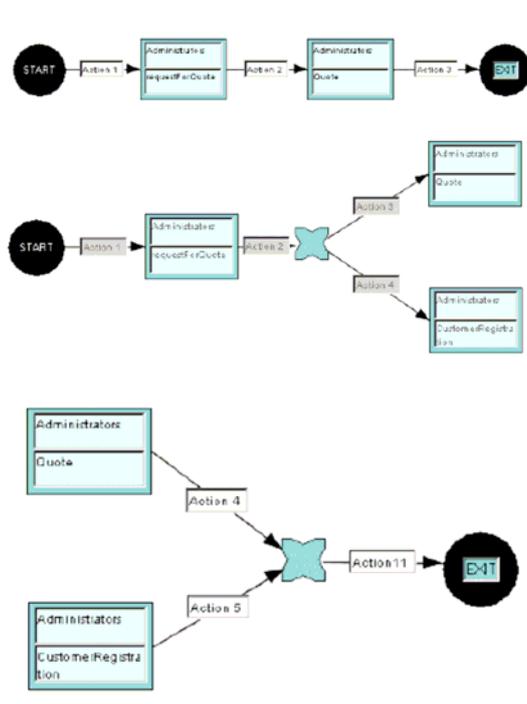
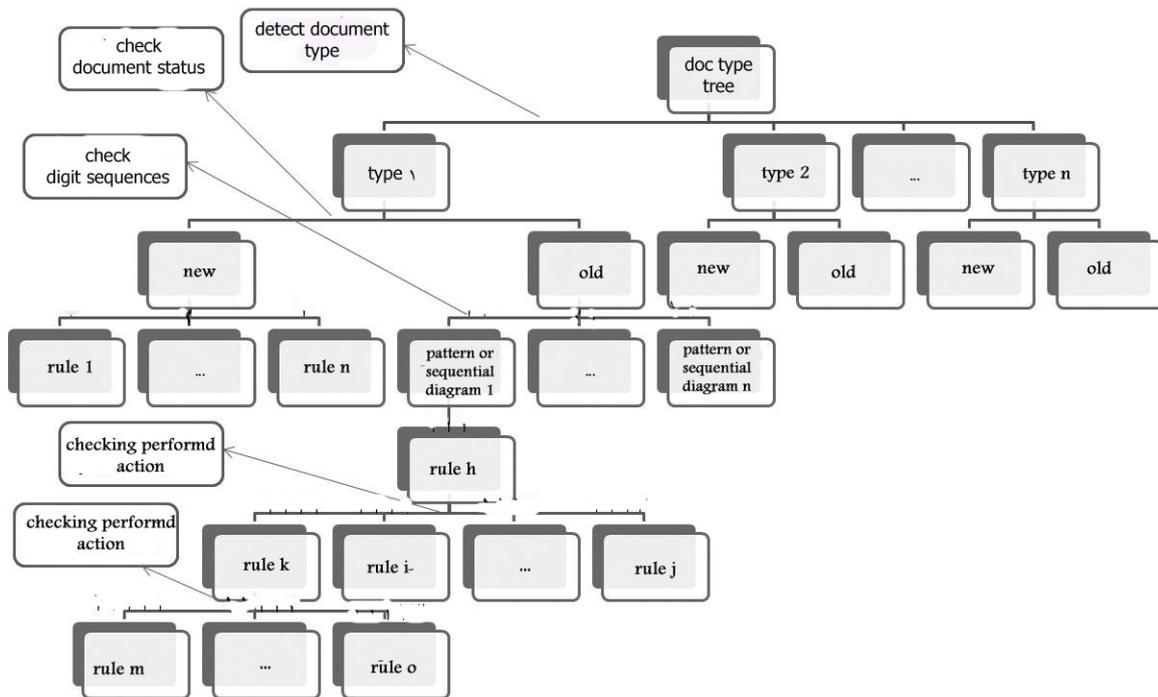**Fig. 3** Some workflow patterns (1, 2, and 3)

Fig 4. Tag Definition for XML file of workflows

- *For each section we consider a tag <tree></tree>*
- *Each <tree> tag has to sub tag: <old> and <new>. If document is new in system, put in the <new> tag and in next flows, go to <old> tag*
- *For each document, we store a sequence of numbers that show document flows and the rules that document were on these rules.*

IV. EVALUATION OF PORPOSED METHOD – ADVTAGES AND DISADVANTAGES

Evaluation of Process

This method, have good answers for important questions in the field of workflow management systems:

- *The proposed method, consider all aspects of workflow systems*
- *This method solves the user requirements of workflow systems.*
- *This method is time and cost optimal*

Advantages of Proposed Method

The main advantages of this method are:

- *High flexibility*
- *Reducing time and operating expenses*
- *Ability of being used as a middleware*
- *Supporting of all aspects of a workflow management system.*

Compare with similar methods

In [13] there is a displayed table to comparing different ways of workflow management. This table accompanies an extra column which is related to above suggested methods. The information of Table 1 is representive the ability of suggested method in operating its duties.

V. TANTALIZATION AND OUTLOOK OF THE FOLLOWING WAY

In this paper workflow process in organizations, Conceptions and expressions, its way of operating and problems and existing shortage were explained completely.

Then we offered an exhaustive approach for workflow management.

TABALE I
COMPARISON FRAMEWORK FOR WORKFLOW SYSTEMS

/method application	standard	platform independent	resource needs	learning need	experience need	availability	flexibility
Zope	+	++	−	−−	+	+	+
XPDL	++	++	−	−−	−	+	−
YAWL	++	−	+	−−−	−−	+	−−
UML	+++	+++	+	−	−−	++	+
GraphViz	−	−	−	+	++	−	−
PNG Image maps	−	−	−−	+	++	−	+
XUL	+	+	−	−	−	+	++
RDF/ML	−	+	−	−−	+	++	−
JavaScrit	+	+	−	−	−	++	−
proposed method	−	+++	+	+++	++	+	++++

This method uses UML diagrams and XML format for simplification and internal power of system. All the existing aspects in workflow management system from the visual aspect till processing aspect have improved the suggested method and are supported completely.

At the end of this article we evaluated our suggested method and we compared it with other methods which release the abilities of this method perfectly.

In spite of all the advantages and abilities that this method has in workflow management in informatics system there are some weak points that are considerable too.

Still managers of organization have to adjust themselves with unusual charts (although this obligation is in the simplest possible way in this method)

In addition, XML trees may enlarge for very large organizations with various documents, plans and duties and effect on processing to some extent, since it is possible lots of documents are performing in the system at a same time, And concurrent processing a tree might produce some problems. For resolving this problem if we could add parallel processing algorithm,

Effectiveness of system would be acceptable for large organization too.

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