Design a Model for Dynamic Workflow Management System

By

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Dedication

This thesis is dedicated to my wonderful parents, who have raised me to be the person I am today. You have been with me every step of the way through good and bad times. Thank you for all the unconditional love, guidance and support that you have always given me. Thanks for your provide me with the confidence that I am capable of doing anything I made up my mind for. Thank you for everything. I love you!

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Prior to acknowledgments, I must glorify Allah the Almighty who gave me courage and patience to carry out this work successfully.

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Lastly, I offer my regards and blessings to all of those who supported me in any respect during the completion of the thesis.

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Abstract

This thesis presents the proposed design a model for dynamic workflow management system. The main purpose for this research is to enhance the performance for information documents transfer between departments in large organizations and companies, thus the transfer will be a one copy transfer between the departments in order to satisfy the concept of E-Company or paperless.

The model consists of three components they are: dynamic process component, database component and activity transaction component. The proposed model is based on human behavior during accomplishing a certain task such as automation of business processes. The proposed model works through the interaction with users using the web base user interface in order to enable users using all the facilities provided by the web base user interface such as the user that can login to the system either through internet, intranet or extranet. The Database component initiates a connection between all components and Database that make use of ADO.Net. Through the dynamic activity creation processes, authorized person can assign the paths and users who are involved in any specific process and assign the flow sequence together with the date and time.

This model can make dynamic workflow engine that manages the entire life-cycle of electronic forms and the processes involved. The proposed model can facilitate the communications between the groups within an organization in efficient manner of movement of information in order to run their businesses effectively. The electronic form processing enables organizations to easily collect information through online mode and process the requests in accordance with predefined business procedures.

Therefore it will save the time and reduce the cost and effort. Applying the proposed model will enhance the information systems to be dynamic for transferring a huge of numbers documents through choosing the type of processes required between departments; then, the authorized person can draw the path and decide the users that are involved in these processes without programmer; so, the end user can do all processes within friendly user interface.

The enhancement of the proposed model in the future may be used in industry instating of concentrating in business; so in this case, the workflow can be called the production workflow. Also it can be used for the strategic information system.

الملخص

تعرض هذه الرسالة اقتراح تصميم نموذج ديناميكي لادارة تناقل وتدفق البيانات والهدف الرئيسي في هذا البحث هو تحسين وزيادة فعالية تناقل المعلومات بين الدوائر في المؤسسات والشركات كبيرة الحجم حيث يتم تناقل البيانات الالكتروني لتحقيق مفهوم الشركة الالكترونية .

يتكون هذا النموذج من ثلاثة اقسام وهي نموذج ديناميكية عملية الوحدات ونموذج قاعدة البيانات ونموذج تناقل البيانات وحركتها . حيث يعتمد النموذج المقترح علي كيفية السلوك البشري خلال انجازه للاعمال التي يقوم بها مثل اتمتة العمليات التجارية ، حيث تتم المعالجة الورقية الالكترونية بجمع المعلومات وعمل الطلبات المراد الموافقة عليها بسهولة . ويمكن للمستخدم النهائي التفاعل مع هذا النموذج من خلال صفحات الويب وذلك بإدخال اسم الشخص وكلمة المرور ويمكن استخدام هذا النموذج على مختلف انواع الشبكات سواء اكانت (Internet, Intranet, Extranet) ، القسم الاخر من هذا النموذج هي قاعدة البيانات وهي وسيط بين كل اجراء النموذج ويتم التفاعل معها من خلال ADO.Net حيث يقوم الشخص المخول بالدخول على النظام ورسم الطريق الذي يجب ان تسير علية العملية والانتقال الى كل الاشخاص بحسب ما هو محدد من البداية ، كما ويضمن هذا النموذج تسهيل تواصل المعلومات بين افراد المنظمة بكل فاعلية وسرعة بالوقت والزمان المحددين .

هذا النموذج يقوم بإدارة تدفق سير العمليات من خلال تناقل النموذج الالكتروني ، ويقوم هذا النموذج بتسهيل الاتصال بين الافراد والجماعات داخل المنظمة بكل فاعلية ومن خلال النموذج الالكتروني ، حيث يتم جمع المعلومات مباشرة Online بحسب ترتيب التناقل والاجراءت والتسلسل الموجود على ارض الواقع .

وبتطبيق هذا النموذج يتوقع ان يقلل الوقت مما ينعكس ايجابيا على التكلفة وتقليلها ،ومن خلال الملاحظة لمحدودية الانظمة الحالية في المساعدة بعملية التناقل الورقي الالكتروني تم اقتراح نموذج يقوم على فكرة ديناميكية التناقل الورقي حيث تبدأ العملية بقيام الشخص المخول بتحديد نوع العملية المراد تناقلها ويقوم برسم الطريق لهذه العملية ويقوم بتحديد الاشخاص المعنيين لهذه العملية بدون الحاجة لوجود شخص تقني(programmer) .وبناء على طريقة وكيفية تصميم هذا النموذج فإن المستخدم النهائي يستطيع القيام بأي عملية بكل سهولة وبدون اي تعقيد خاصة وانه يقدم مرونة في التعامل مع المستخدم النهائي .

من الممكن ان يزداد استخدام النموذج المقترح في المستقبل بتركيز استخدامة في مجالات الصناعية بدلا من التركيز فقط على استخدامة المجالات التجارية لهذا اصبح بالامكان من تسمية عملية تدفق البيانات بتدفق العمليات والبيات الانتاجية والتي سوف تستخدم في عملية رسم استراتيجيات المؤسسة

Chapter One

Introduction

1.1 Introduction

In this century, the application of infrastructure of Information Technology becomes very important; most of the enterprises and organizations willing to improve their businesses through the new philosophy of business reengineering. The processing of information in any organizations required some tools to cope with reengineering their businesses such as using automation of their existing processes and reacting quickly to the changes in the business environment.

Usually, the communications between the groups within an organization depend on the efficient movement of information in order to run their businesses effectively. The automation of business processes, in whole or parts, where documents, information or tasks are passed from one participant to another to be processed, according to a set of procedural rules called "Workflow" (Nourah 2007). Workflow can be described simply as the movement of documents and tasks through a Business process. In other words, it can be a sequential progression of work activities or a complex set of processes each taking place concurrently, eventually impacting each other according to a set of rules, routes and roles (Marco 2002).

There are many definitions of Workflow such as the numbers of process-modeling techniques which are available to define the detailed routing and processing requirements of a typical workflow. Also, there is another description for workflow; it is the automation of business processes, in whole or part, during which documents, information or tasks are passed from one participant to another for actions, according to a set of predefined procedural rules because business information moves quickly and the manual collection of data can lead to reduced productivity and costly delays (Buffy Schnurbusch 2009).

Workflow provides easy, flexible and integrated of any application software solutions for organizations virtually, thereby enabling dramatic improvements in productivity, accountability and compliance. The term workflow is used in computer programming to capture and develop human-to-machine interaction.

Usually, the most available application of Workflow is tightly integrated with Microsoft products such as Microsoft Office Share Point® Server 2007, Microsoft Office InfoPath® 2007, Microsoft Office Outlook® 2007, Microsoft BizTalk® Server 2006 and the Microsoft .NET Framework 3.0; so, users can manage individual work tasks within familiar Microsoft programs (Microsoft 2009).

The Workflow can also provide organizations with the facilities of enhanced capabilities for developing, deploying and managing automation business processes in the industry sector (Captaris 2009). Workflow provides secure and efficient user experience with roles assignments, task list enhancements for the windows and the web user. In addition, key performance indicators are viewable and manageable in the task list and the custom workstation presentations (faxsolutions. opentext 2009). In the Microsoft operating system environment, Workflow is a solution for adding business process management to Microsoft environments, offering benefits to each group of users, including information workers, software designers, business managers, and systems administrators. Workflow gets the work done without restricting the information worker; Workflow solutions allow for a variety of client deployments windows, Web and wireless and Workflow provides systems administrators with all of the tools needed for easy deployment and management. Electronic forms processing enable organizations to easily collect information through online forms and process the requests in accordance with predefined business procedures.

Electronic forms processing enable organizations to easily collect information through online forms and process the requests in accordance with predefined business procedures. It eliminates the need for data entry workers keying in data from paper forms and operators no longer need to decipher handwriting.

The proposed solution is the management of the entire lifecycle of forms and the processes involved which is called Workflow Management System (WFMS). Therefore, the Workflow Management System can be defined as a system allows organizations to define and control the various Activities associated with a business process. In addition, many management systems also allow a business the opportunity to measure and analyze the execution of the process so that continuous improvement can be made. In order to improve the capability to respond dynamically to process changes, dynamic workflow model base on flexible activities and historical information have been introduced (Peng Li & Yuyue De 2009).

In early 90s, increasing number of workflow applications specified two new important requirements for WFMS, namely integration with existing applications/services and co-operation among different WFMS (Mariusz 2005). The first Application integration is a major trend in information technology today. Three of the major trends in information technology today are the Web, enterprise software packages, and application integration. The Web provides an environment that can link a company's customers, suppliers, partners, and its internal users. Enterprise software packages offer an integrated environment to support business processes across the functional divisions in organizations. Some packages, like Enterprise Resource Planning (ERP), for example, SAP R/3 and BaanERP, manage back-office requirements, while other packages provide front-office capabilities, e.g. customer services. Common to web base user interfaces as well as enterprise software packages is the need for application

integration. Application integration is required to connect front office systems with back office systems to transfer business processes to the Web, and to create extended supply chains involving customers, partners and suppliers. Application integration is also needed for wrapping legacy systems and for migrating to new environments. The demand for application integration is also fuelled by the move to process orientation in many organizations. Traditionally, organizations have been functionally divided, i.e. companies have been separated into departments such as market, production, and service. However, the functional organization has been shown to have a number of weaknesses. In particular, it requires a huge administration to handle issues crossing functional borders, and considerable resources are allocated to tasks that do not create value. In order to overcome the problems of a functional organization, companies have been concentrating on business processes, i. e. the set of related activities that create value for the customers. These processes cross the related activities that create value for the customers. These processes cross the internal borders of an organization and also sometimes the external borders to other organizations (Paul & Erik 2000). The second is co-operation among different WFMS framework, the purpose of a cooperative framework for inter-organizational workflow systems. The framework consists of an inter-workflow meta-model, CA-PLAN (Cooperative Agent flow Process LANguage), and a prototype system based on Agent flow, a system developed in our laboratory. The cooperation mechanism between WFMSs in CA-PLAN is modeled as a Remote Call Process (RCP) paradigm.

A Process service is a mechanism that defines a process to participate in an inter-organizational process among different WFMSs and specifies the associated arguments in and out. A Remote Process is a proxy mechanism that refers to a process service on another WFMS. RCP provides the mechanism by which the process service and the

remote process communicate and pass information back and forth and process monitor mechanism. The mechanism, also allowing dynamic changes and reconfiguration, can adapt dynamic and competitive business environment. Through RCP, the cooperative process across organizations becomes simple, faster, and flexible.

1.2 Motivation

Despite many advantages resulting from the application of the WFMS, but observed, there are many limitations of using the WFMS. One of these many limitations is the assumption of the business processes that do not change frequently during their execution. In reality, the nature of the processes needs to adapt the dynamic changes in workflow environment (i.e. resources, data and applications) as well as workflow itself. For example, the head of a department would like to select a person who will process a given claim. This selection should be done dynamically from the list of all employees in this department (Jorge Cardoso et al 2002).

Flexible workflow processes are also considered together with shared knowledge and continuous process improvement as a crucial element of so-called knowledge era (Moore 2000). An approach to increase processes adaptability is to make their definition more flexible. In this context, flexible means that it is possible to express within a workflow process definition complex dynamic requirements that depend on process execution history as well as current organizational and application data. There are many advantages for using this model according to the facing problem in current situation, these are:

1. Increase the employee's productivity by simplifying everyday business activities. Through the use of out-of-the-box workflows for initiating, tracking, and reporting

common business activities such as document review and approval, issue tracking and signature collection and can complete these activities without any coding.

2. Satisfy the regulatory requirements through comprehensive control over content by specifying security settings, storage policies, auditing policies, and expiration actions for business records in accordance with compliance regulations, you can help ensure your sensitive business information can be controlled and managed effectively. And you can reduce litigation risk for your organization.

3. Managing multilingual content is simplified through new document library templates that are specifically designed to maintain a relationship between the original version and different translations of a document; therefore , effectively manage and repurpose content to gain increased business value. Since the users and content's author can create and submit content for approval or scheduled deployment to intranet or Internet sites in order to Connect the employees with available information and expertise.

4. Collaboration and shared information: This technology is inherently relies on a sharing the WFMS between all departments of the organization in which information can be created and used by all the members of a particular group.

5. Minimize the time and cost for the high frequency processes in organization, for example, (people Signature, Packaging Approval in industry pharmaceutical, other).

6. Improve performance for the employees in organization through the use of information technology facilities such as Internet Explorer, Electronic Resource Planning (ERP), Document Management Systems, and there are many others.

1.3 Contribution

The WFMS solution consistently generates outstanding results, especially, when using dynamic processes and dynamic activities because there is much inherent inefficiency in the current Business Processes Management systems (BPM), particularly, those with a large amount of data and information processed manually. The benefits of using the proposed WFMS model with the dynamic processes and dynamic activities,

1. Efficiency: Usually the main resources of computer system are the space presented as the main memory, the time presented as the processor time, and communication presented as the I/O devices. Therefore, the WFMS will not be made wasteful use of the computer system resources and the employees will be more productive with the minimum use of computer system's resources.

2. Usability: The system will be usable through the user interface as user friendly and easy used. This means the use will not spend complex effort; so, the user interface has an appropriate forms and adequate documentations.

3. Customer Satisfaction: The system will be accepted by the users for which it was designed. This means it must be understandable, usable and compatible with other systems.

4. Maintainability: Software should be written in such a way that it may evolve to meet the customers, changing needs. This is a critical attribute because software change is an inevitable consequence of a changing business environment.

   In order to be ensure about this contribution can be used a questionnaire after the implementation of the proposed model.

1.4 Project Requirements

In this project, the minimum requirements of the hardware and software used can be in two groups; these are the hardware requirements and the software requirements. The software requirement consists of the following.

- ASP.NET is a set of Web development tools offered by Microsoft. Programs like Visual Studio .NET and Visual Web Developer allow Web developers to create dynamic websites using a visual interface. Of course, programmers can write their own code and scripts and incorporate it into ASP.NET websites as well. Though it often seen as a successor to Microsoft's ASP programming technology, ASP.NET also supports Visual Basic.NET, JScript .NET and open-source languages like Python and Perl. ASP.NET is built on the .NET framework, which provides an application program interface (API) for software programmers. The .NET development tools can be used to create applications for both the Windows operating system and the Web. Programs like Visual Studio .NET provide a visual interface for developers to create their applications, which makes .NET a reasonable choice for designing Web-based interfaces as well. In order for an ASP.NET website to function correctly, it must be published to a Web server that supports ASP.NET applications. Microsoft's Internet Information Services (IIS) Web server is by far the most common platform for ASP.NET websites. While there are some open-source options available for Linux-based systems, these alternatives often provide less than full support for ASP.NET applications

- ADO.NET: is a set of classes that expose data access services for .NET Framework programmers. ADO.NET provides a rich set of components for creating distributed, data-sharing applications. It is an integral part of the .NET

Framework, providing access to relational, XML, and application data. ADO.NET supports a variety of development needs, including the creation of front-end database clients and middle-tier business objects used by applications, tools, languages, or Internet browsers.

- DBMS using SQL server 2005: SQL (Structured Query Language) is a largely standardized language for accessing relational databases. It can be divided into three areas:

- Data Manipulation Language (DML): Statements for reading and changing data in database tables.

- Data Definition Language (DDL): Statements for creating and administering database tables.

- Data Control Language (DCL): is used for securing databases , DCL does this by providing two main SQL commands, GRANT and REVOKE GRANT is to allow certain users access to particular parts of a database. Adversely, REVOKE, Specifically denies user access to particular parts of a database. (msdn.microsoft 2009).

The minimum hardware requirements are presented in table-1; usually , the basic requirement is a server with the following specifications according to the work environment based on the number of users in the organization (ERP Company) and the application software required for running the business of the organization.

Table-1 the minimum hardware requirements

Component	Requirement	Recommendation
Processor	133-megahertz (MHz) or higher processor	733-MHz or higher processor
Operating system	Microsoft Windows 2000 Server, Windows 2000 Advanced Server, or Windows 2000 Datacenter Server with SP3 or later Windows Server 2003 R2, Windows Server 2003, Standard Edition; Windows Server 2003, Enterprise Edition; or Windows Server 2003	Windows Server 2003
Memory	256 megabytes (MB) of RAM	512 MB of RAM
Available hard-disk space	500 MB on the hard disk where you install Exchange Server 2003	500 MB on the hard disk where you install Exchange Server 2003
	200 MB on the system drive	200 MB on the system drive
Display	VGA or higher resolution monitor	VGA or higher resolution monitor
Input device	Microsoft Mouse or compatible input device	Microsoft Mouse or compatible input device
File format	Disk partitions must be formatted for the NTFS file system, not the file allocation table (FAT) file system.	Disk partitions must be formatted for the NTFS file system, not the FAT file system.

1.5 The Problem Statement

Usually in the study and research for any problem, the first step is the definitions of the associated problems in the field concern. There are many problems related with the WFMS, these are:

1. The workflow adaptability and standardizations: The efficiently movement of information within an organization usually depends on the adaptability of workflow and standardizations used to run their businesses effectively. Inefficient movement of information and manual collection of data lead to

reduction in productivity and costly delays. To optimize the processing of information in an organization, the organization needs a Model to efficiently automate its existing processes and react quickly to changes in the environment.

2. Static form and application: this is Restricted for the end user because when we need to make any change for this form, we must refer to the programmer to insert or drop any component; to solve this problem, we will propose dynamic form and application and allow to the end user to use the form and application by more flexible; this is the first step to apply the dynamic workflow engine.

3. Static activity: if we refer to introduction, we can define the activity which is a road and path that all processes will move through it from starting the process till reaching the end user; but, the obvious problem in this point is the activities that are deployed by programmer; and it is used in specific aims, which means we can't use that process in general.

4. Static rules: the rules are business logic issues that made by XML language. The rule can develop the activity; but, it can program for once. The rule is reflecting to the activity from the engine side; in this thesis, we will discuss how the user can make dynamic activity then reflect it to become a dynamic rule.

Therefore, it requires specific functionalities such as resilience, sophisticated exception handling mechanisms, fault-tolerance and user interactions that need particular attention. Shadowing workflows that complement the usual abstract-concrete workflow Implementations and event-based exception handling mechanisms are required to support these functionalities, which require several components for their effective implementation.

The most importance component is the design of efficient methods for mathematical models, numeric problem solutions and data processing. This involves the optimization of complex application codes that might include intricate and distributed execution tools. This includes the asynchronous execution of coordinated tasks executing in parallel on remotely connected environments. The other importance component required is the dynamic activities and the dynamic transactions to be implemented and running to support the execution of the Workflows. Also it includes sophisticated tools that allow the users to interact dynamically in explicit and coordinated ways to design new WFMSs.

1.6 Objective

The workflows have been used for many organizations in order to provide the facility of enhancing the deploying and managing automation business process in industrial sector.

But most of the workflows are not capable for dynamic processes and activities, so in the proposed model, these two factors have been considered during the design of the model.

1.7 Thesis Structure

The thesis consists of five chapters, the descriptions of these chapters as follows:

The chapter one consists of six sections, which are an introduction to the application of infrastructure of Information Technology at present and specially the applications, usually the communications between the groups within an organization depend on the efficient movement of information in order to run their businesses effectively, Workflow can be described simply as the movement of documents and tasks through a Business process. Also, there is another description for workflow; it is the automation

of business processes, in whole or part, during which documents, information or tasks are passed from one participant to another for actions, according to a set of predefined procedural rules, because business information moves quickly and the manual collection of data can lead to reduced productivity and costly delay. Also, it includes the problem statement. In this section , it presents many problems associated with the workflow such as the adaptability and Standardizations, Static form and application, Static activity to makes dynamic activity and road or and path, Static rules are business

Chapter two Literature survey and related works; this chapter presents many research papers related work involved in workflow management system. Logical issues are made by XML language.

Chapter three the Methodologies Used for WFMS; this chapter presents many methodologies used in WFMS.

Chapter four proposed Solution; in this chapter, we are presenting the proposed model for design and implementation Workflow Management System. The architecture of the proposed model consists of three components, these are: the first is Dynamic Process component which consists of three Parts Dynamic Process component this part consist of web base user interface, generating dynamic process form and creation dynamic activities, second part is database component; this component Using the Data Access Responses in Order to initiate a connection between all components and Database by using ADO.Net and drawn The ER-Diagram to show the Relationship table the last component is Activity Transaction component: in this component present its transaction or processes can move after the Authorized person (Manager or Administrator) finished draws the path or role.

Chapter five Conclusion and future work in this chapter presents the findings and conclude the ideas in a concise way.

Chapter Two

Literature survey and related work

2.1 Introduction

There are many researchers have been done related to the concept of Workflow most of them are closely related to other concepts used to describe organizational structure, such as rules, activities, projects, policies and organization. This thesis presents the researches related to the aim of the project and are divided into three types, related with Dynamic Workflow, related with Integration and distributed system, and related with Standardizations and adaptation and are described in the next sections.

2.2 Literature Survey Related to Dynamic Workflow

Peng Li and Yuyue De (2009) present improving of the capability to respond dynamically to the process changes, and how to make dynamic workflow model base on flexible activities and historical information that have been introduced. Each flexible activity is used to encapsulate a group of indeterminate factor, including the constraint rules and optional activities that to be used when reifying flexible activities. Historical execution information is the execution logging of a previous workflow instance. Two algorithms are put forward to guarantee the correctness of sub-workflow and the introduced workflow model. This method can be widely used in modern manufacture industry, especially, for the businesses that might vary frequently. However, this model ignores the loop structures in sub-workflow and the flexible activities reifying processes are not intelligent enough.

W.M.P. van der Aalst (2009) he a pragmatic approach made to tackle the dynamic change bug. The researcher proposed the workflow model Based on the syntactic changes in the graphical; three types of change regions are calculated. These types of change are static change region which incorporates the parts of the workflow model directly affected by the change. The other change is the dynamic change region extends

the static change region to incorporate the parts of the workflow model indirectly affected by the change. The minimal change region reduces the dynamic change region by eliminating border nodes. The minimal change region is a subset of the dynamic change region. The main result of this paper is those cases (i.e., workflow instances) which leave the minimal change region unmarked and it can be transferred from the old workflow to the new workflow without creating problems such as deadlocks and live locks: Successful termination is guaranteed. In the future, there should be a plan to implement the approach presented in this research by using a commercial workflow management system.

Francois and Adnene Guabtni, (2006) they present issue of dynamic workflows coincides with dynamic planning in Artificial Intelligence by attempt use of past experience for challenging problem that cannot be solved by a simplistic proposal. However, they wish to set the stage for a significant progression and in a reasonably short of time in the manner of simplicity and effectively for workflow system

2.3Literature Survey Related to Integration and Distributed Systems

Toannguyen and jean-antoine (2009) present Workflow system in the business administration area to automate and effectively support administrative document processing. Several workflow engines have been developed and are disseminated as open-source software. The inventions of distributed computing environments, e.g., grid middleware have also emphasized their ability to support large-scale distributed simulation and optimization applications. These will be regarded as specific properties that severely constrain the workflow systems, e.g., long duration runs, peta-scale data sets, dynamic parameterization interfaces. Their research focuses on some open challenges in deploying and running distributed Workflows for metaphysics design.

Lerina Aversano, et al. (2001) state the critical points for developing successful information systems for distributed organizations and propose the need for integrating heterogeneous technologies and tools. They suggest the integrating workflow and document management. In this research, different document types are used through the use of hypertext systems and markup languages in order to combine the database and information retrieval technologies. The suggested workflow prototype used in this research was in two different levels: the document level and user interface level. The integration at the document level combines document and workflow analysis and modeling. Therefore, information will be collected during the analysis of the business processes needs in order to focus on the document structure and life cycle the workflow of the process activities. They use UML to build static and dynamic models of each document type involved in the process, specifically, UML class diagrams that have been used to model the structure of the documents and the relationships among them; while, the document life cycles have been formalized through state diagrams.

Bastin T R Savarimuthu, et al. (2005) use a real life example of integrating web services with a diamond processing workflow driven by agents. They present description of flexible, agent based architecture for workflow management systems. The agent based architecture facilitates the easy integration of Web Services with the workflow system. They suggest extending their architecture to accommodate a process model that executes composite web services. Also, they suggest extending their work to form a society or institution of web service agents that can work collaboratively to achieve a common goal.

2.4Literature Survey Related to Standardizations and Adaptation

Jian et al. (2007) present an important problem in the current workflow system that related to the adaptability of workflow. The objective of this research is to provide the user with the ability to change the process model without any restriction. In order to achieve this goal, a formal workflow process model is defined as the basis of the paper. After the process model is changed, two issues should be addressed. The first one is how to judge the effects of a process change to the current running instance and the other one is how to verify the correctness of modified process model. To solve the first problem, the concept of valid process is introduced as the basis to judge the effect caused by process change. Generally, there will be more than one instances of a workflow running at the same time while staying at different stages. The method provided in the research can deal with the change on one instance. To solve the dynamical change problem for more than one instance can also be based on the valid process. The valid process model can also be applied to simplify the process model so that the computation scale can be reduced. The effects of both methods make the verification problem for dynamic process change relatively simpler; this model separates the logic relationships from the activities themselves and provides conveniences to the process change. They proposed two methods to improve the adaptability of a WfMS, one is called a-priori flexibility that means to define all possible cases during the modeling phase and the other is called a-posteriori flexibility. Therefore, the model change is allowed when the instance of workflow is running a posteriori method is more realistic than a-priori one most graphic workflow model such as ADEPT which defines the logic relationships among activities through their input characters (AND-join, OR-join) and output characters (AND-split, OR-split). Their model makes logic relationships among activities be closely coupled with activities

themselves. Since model change usually only means to adjust the logic relationships among activities, the coupling relationships among activities and their logic relationships lead to this kind of change more difficult. In the workflow model defined below, activities and their logic relationships are decoupled and activities must be connected with each other through some logic nodes.

Fran et al. (2005**)** present an approach that enhances the idea of flexibility in workflow management. The process execution is considered as a program execution where the program is written at runtime by its users. Processes are created by hand or by importing or cloning existing processes using certain type of software packages. The only part of a program is the one that has already been executed. This requires also supporting process definition with library of predefined process fragments that solve generic problems that may occur in cooperative processes (some kind of cooperative process patterns) that need to be defined. It means also that we need to provide more help for users with, for instance, a greater integration of the process with the user environment. The WFMS should be able to guess that the user is working on a given task and even that he has finished working on it; also it should provide some kind of computation to do list management system easily accessible by users. These are some paths that we plan to explore in a near future.

Michael's & David's and Arthur's (2002) work extends the potential applicability of activity theory to the implementation of more flexible and better directed workflow support and management systems. Activity theory offers a number of interesting insights into current workflow research domains, particularly, the related issues of workflow adaptability, flexibility, evolution and exception handling. It is intended that the principles derived will provide guidance for further research in these areas. While the commercial products reviewed support few of the principles derived from activity

theory, and research prototypes that support some individuality; there are no systems that meet most or all of the principles. A more flexible workflow system may be one that is based on accepted ideas of how people work rather than on programming principles. They derive a set of independent principles for workflow that support based on activity theory a formal theory of human work activities.

Diimitrios Georgakopoulos, et al (1995) proposed methodology for the workflow system and they view the workflow which is a concept closely related to reengineering and automating business and information processes in an organization. They describe workflow as business process tasks at a conceptual level necessary for understanding, evaluating and redesigning the business process. The primary function of workflows is to capture information process tasks at a level that describes the process requirements for information system functionality and human skills. The distinction between these workflow perspectives is not always made and sometimes the term workflow is used to describe either, or both, of the business and information systems perspectives. They suggest workflow management which involves everything from modeling processes up to the synchronizing activities of information systems and humans that perform the processes. In particular, management of a workflow includes the following:

1. Process modeling and workflow specification: The methodologies requirement for workflow models and for capturing a process as a workflow specification. Is needed
2. Process reengineering: The methodologies requirement for optimizing the process.
3. Workflow implementation and automation: The methodologies requirement for use the information systems, and human performers to implement, schedule, execute, and control the workflow tasks as described by the workflow specification.

Chapter Three

The Methodologies Used for WFMS

There are five most generally recognized standardization bodies that published standards on workflows (WFMC-TC-1023, 2001); these are:

1. Workflow Management Coalition,
2. Workflow and Reengineering International Association,
3. Object Management Group,
4. Business Process Management Group and
5. Business Process Management Initiative.

These organizations have developed many methodologies for workflow; the following sections will be the description of most of them.

3.1 The Reference Model

The architecture of the reference model use the WfMS as a system that consists of six modules (Work Group 1, 1998), these are:

1. Process Definition Tool,
2. Workflow Engine,
3. Client Applications,
4. Invoked Applications,
5. Administration and Monitoring tools and
6. Workflow Engine Interoperability.

The basis of this model is the WFMS coalition specified through the interfaces between Workflow Engine and the rest of the above mentioned modules. These interfaces have been published as separate standards. Together with the reference model, the coalition presented a

workflow process model known as the process meta-model. This model specifies the basic entities of a workflow process such as activity, workflow participant, transition, etc.

3.2 Workflow Process Definition Language (WPDL).

On the basis of the meta-model, the coalition proposed a language to represent workflow process definition, namely Workflow Process Definition Language (WPDL). In WPDL, a workflow process was described in a textual form according to the WPDL grammar. After popularization of markup languages, WPDL has been adapted to extensible Markup Language (XML) representation and is known as XML Process Definition Language (XPDL). On the market, there is another competitive language to define business processes: Business Process Modeling Language (BPML) from BPMI. In BPML, a workflow is also represented using the XML notation. Basically, it offers similar functionality as XPDL does, however, detailed specification is quite different (e.g. SPLIT and JOIN operations - cardinality). Some issues on similarities and differences between these two languages have been presented in .Since the interface available for workflow interoperability specified by the WFMS coalition had been criticized for its complexity and inadequacy in a distributed environment, two other protocols have been suggested: Simple Workflow Access Protocol (SWAP) and jFlow from OMG. Both protocols use the HTTP protocol to exchange information between different WfM systems. In addition, the authors of jFlow suggest that the reference model should also be simplified in order to be appropriate for Web communication. As a response for such effort, the WfM coalition presented a new workflow interoperability protocol, namely Wf-XML Binding.

This protocol includes ideas presented in the WfMC's MIME binding specification as well as those in SWAP and jFlow. In Wf-XML, HTTP protocol is used as a data transport mechanism for exchange of Wf-XML messages. The body of such a message is written in

XML. Recently, as an answer for the increasing need to integrate Web services into WfM systems, there have been proposed some extensions either to workflow definition languages or to web service description languages. At the end of July, 2002 IBM, BEA and Microsoft presented the first version of Business Process Execution Language for Web Services. This language is based on work presented in BPML and mainly extended of execution web services as activities. Another example is Web Services Choreography Interface (WSCI) proposed in June, 2002 by Sun, BEA, Intaglio and SAP. At the end of July also the WfM Coalition extended XPDL by adding execution of Web services. (Hab. KazimierzSubieta 2005).

3.3 Automatic Workflow Modeling

Yan Li Yuqiang Feng (2006) presents a method for Automatic Workflow Modeling which is called the workflow mining. This new method has the capability of automatic modeling, strong objectivity, high efficiency and low cost; so, it can improve the modeling quality and support well the cooperative work. The workflow mining algorithm is based on Markov transition matrix, which can reduce the effect of complexity of process structure and quality of workflow logs on the process mining and improve the automatic modeling efficiency.

Dynamic Workflow: As a technology that can improve the efficiency of the Business process, workflow is drawing more and more attentions of researchers and software product vendors; but there are still many problems waiting to be solved for workflow. One of these problems is static workflow this leads to poor adaptability and flexibility of workflow. In these theses, he intends to enhance the adaptability and flexibility from the view of supporting dynamic workflow on process model for workflow instance.

There are many researchers who are concerned about the issues related to the adaptabilities and flexibilities of the dynamic changes in the processes and activities.

3.4 Workflow Management Support System

Diimitrios Georgakopoulos, et al (1995) suggest the importance of infrastructure of information technologies for workflow management to be

Efficient and reliable support for workflow implementation and execution and identifying the supported keys from the distributed computing environment These are:

1. Supports integration and interoperability among loosely-coupled HAD legacy and new systems.
2. Supports workflow applications that require access to multiple HAD systems, ensures, correctness and reliability of workflow applications in the presence of concurrency and failures.
3. Supports evolution, replacement and addition of workflow applications and systems as business processes change.

Also they suggest the basic categories of process modeling methodologies, these are:

1. The communication-based methodologies

. This methodology assumes that the objective of business process

Re-engineering is to improve customer satisfaction.

2. Activity-based methodologies focus on modeling the work instead of modeling the commitments among humans.
3. Object-oriented methodologies: The object designer typically must define workflow model-specific objects from scratch. This problem can be addressed if workflow- model-specific types and classes are defined to support business process modeling directly

3.5 Proposed Methodology

In this thesis, a workflow model that is fit for dynamic workflow is defined and describes the dynamic workflow components such as dynamic processes, dynamic forms and solve the adaptability and flexibility problem brought by workflow instance dynamic workflow.

The proposed dynamic workflow model will focus on cooperation between three components in adaptable and flexible manner; these components are:

- Dynamic process component.
- Database component.
- Activity Transaction component.

Dynamic process component: This is the core component in this model and consists of three parts:

- Generating Dynamic Process Form: allow to the end user to use the form and application by more flexible to generate any component in this form for example (text, label,..), on other side, Static form and application are Restricted for the end user because when we need to make any change for this form; we must refer to the programmer to insert or drop any component.
- Web base user interface: The web base user interface allows the user to login into system and interact between them.
- Creation Dynamic activities: authorized person can assign the paths and users which are involved in any specific process and assign the flow sequence together with the date and time.

Chapter Four

Proposed Model for Workflow Management System

4.1 Introduction

The purpose of this research is to Design a Model for Dynamic Workflow Management System. The model shows how the dataflow, which can be regarded as transaction unit, will move between all the departments of an organization using the dynamic process method. The objective of this model is easy and faster than the collection of data and the creation of transaction of dataflow in the automation of the information processing. The proposed model is based on human behavior during accomplishment of certain task, which consists of the following steps:

1) The normal user chooses the type of process that he need (the user in this level called initiator). The initiator fills the needed data that concern the process type and form; so, in this level, it is a normal round; normal users can't change in this form. It is the first step to make a dynamic engine; the dynamic engine is a procedure which in concerned with permission and organization which the authorization, will send all data to the manager who has extra permission.

2) The Manager will open the form as in the above point by the initiator; the manager has a dynamic form that assists him to check about to finish.

   if it is not ok, he asks from the initiator to make some changes, and the status in this time will be (No), that is, not accept from the system, the initiator makes changes that asked and his role will end; in this level, the manager can add any component, text and attachment that will serve another user to understand the process.

3) After the process is sent, it receive from the first user; he browses the content and has (Yes, No) options, after he decides the appropriate decision, he sends it to complete the path of process. When the real path ends, the system will check about this process if there is anyone to select No, the process will return to the

initiator, he will make the suit changes either in content or in the path by adding or deleting users from the roles.

Figure 4.1 presents the context flow diagram for the proposed model and figure 4.2 presents the o level of logical flow diagram. The proposed model will be described in details in the next sections.

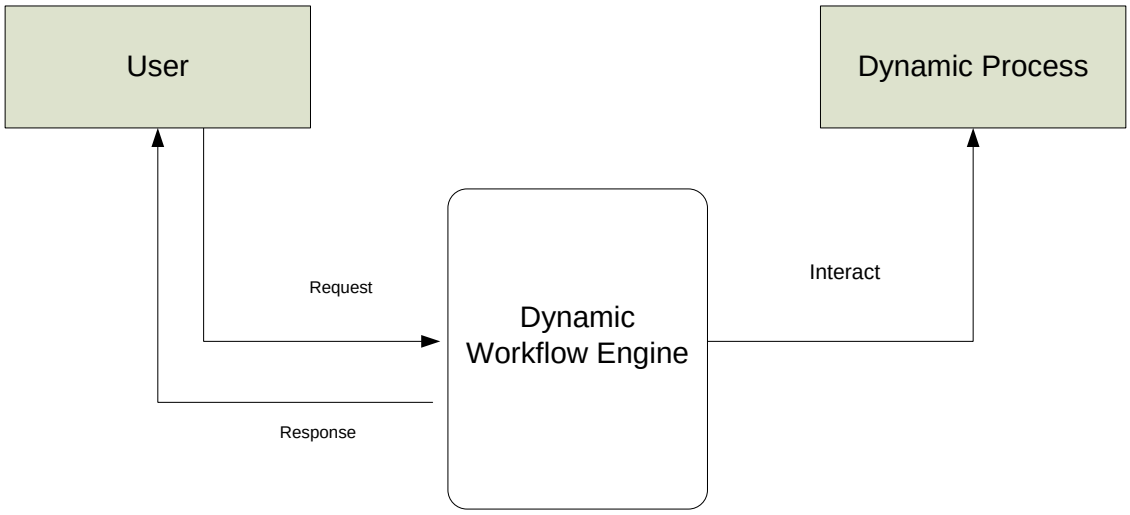

Figure-4.1 Context Flow Diagram

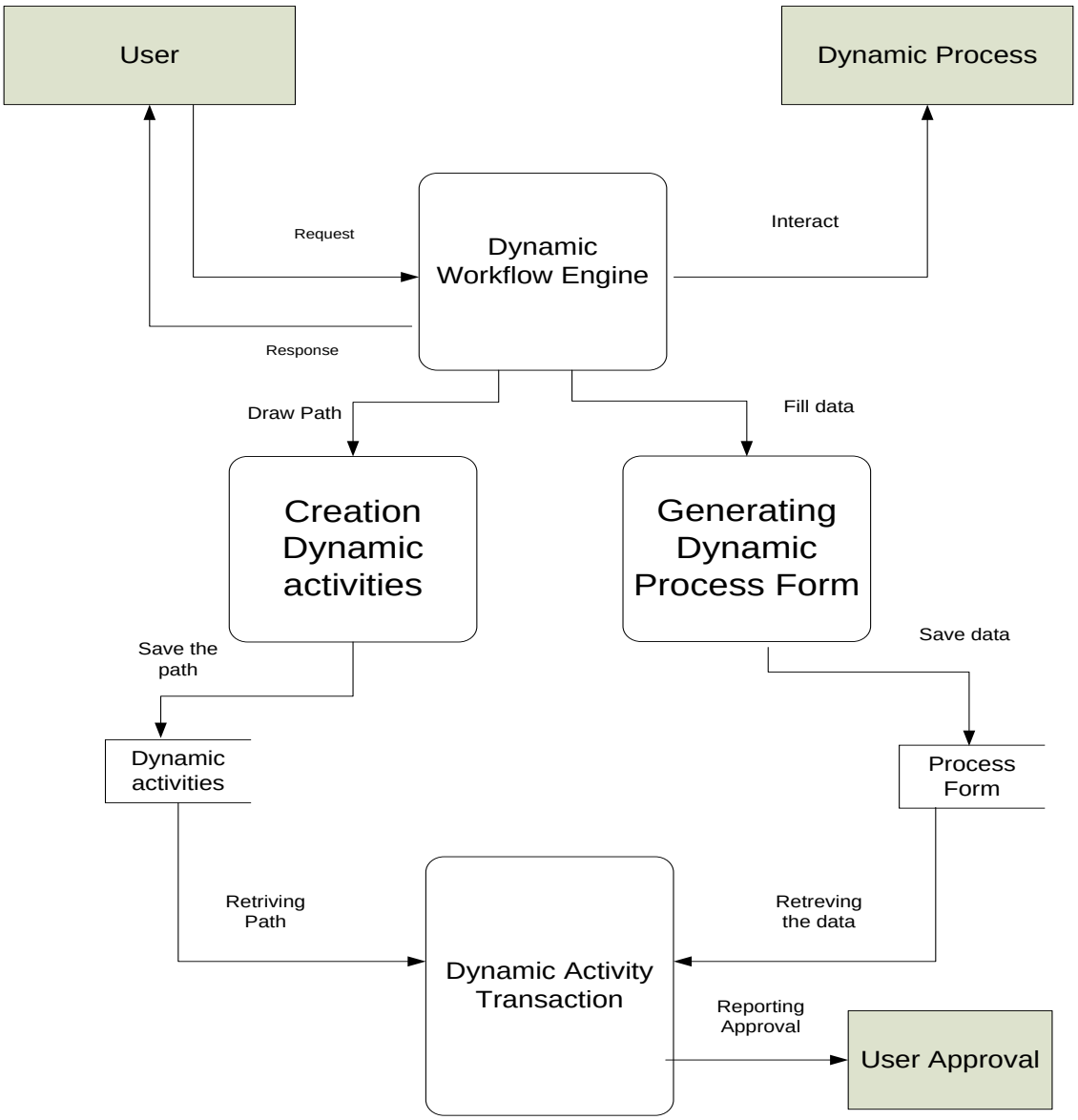

Figure-4.2 Level (0) Data Flow Diagram

4.2 The Architecture of Proposed Model

T he proposed model consists of three components as seen in figure- 4.3, these are:

1) Dynamic Process Component.

2) Database Component.

3) Activity Transaction Component.

In the following subsections are the details descriptions of all three Components

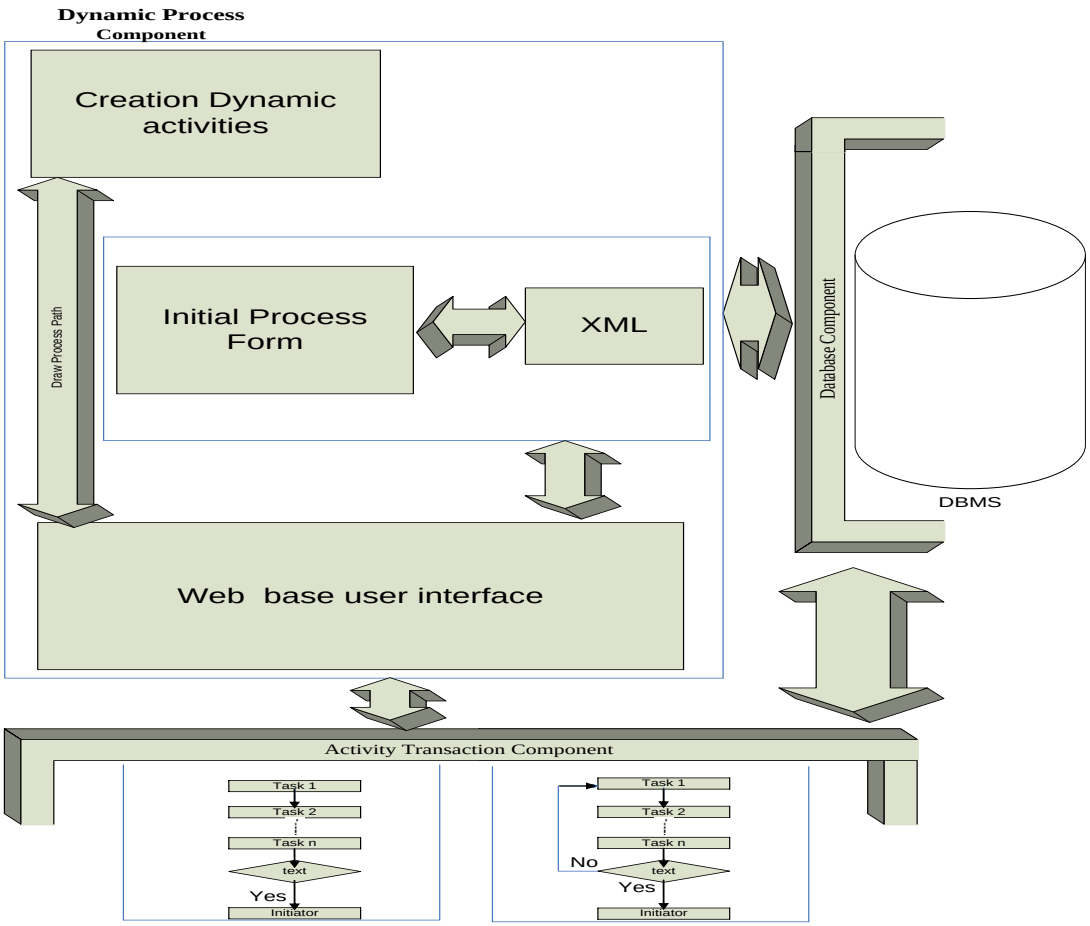

Figure-4.3 Architecture of the Proposed Model

4.2.1 Dynamic Process Component:

The Dynamic Process component consists of three Parts these are:

A. Web base user interface

The proposed model of the system works through the interaction with user. The interface includes web base user interface as well as it contains login screen after the user input his own user name and password. Then, it will verify to take the own authentication from database which depend on permission associated for each user that given before. User can select the type of process as (vacation, signature approval...etc.), as shown in figure 4.4. Therefore the user will be able to use all the facilities provided

by the web base user interface. The web base user interface allows the user to login to the system through (internet, intranet or extranet).

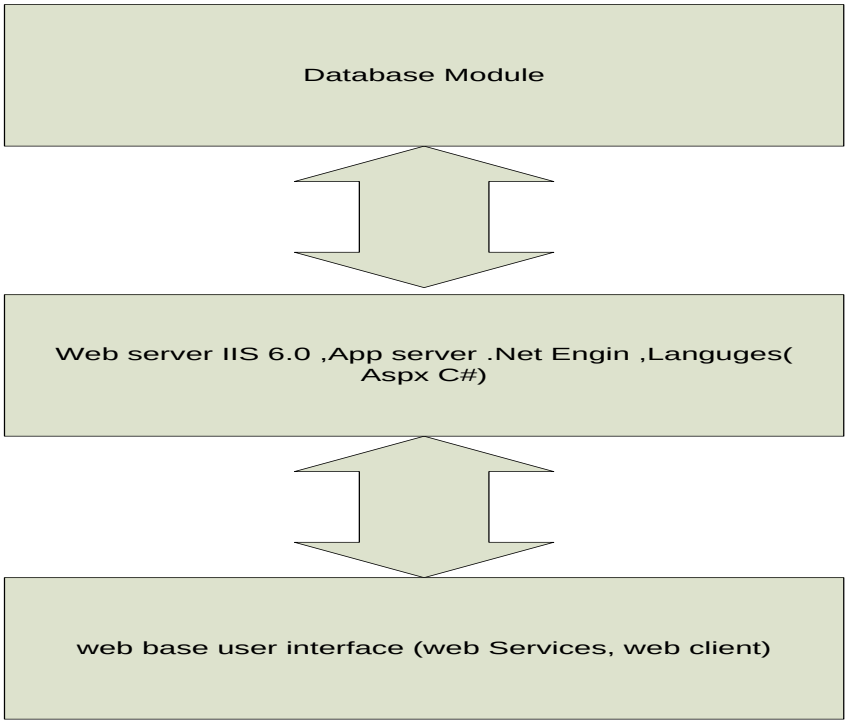

Figure-4.4 Web base user interface

B. Generating Dynamic Process Form

Figure 4.5 shows the process of generating dynamic process form through the user fills the specific field and if he wants to add any data that doesn't have location as (Text, Label, and any component), he presses on the generate text bottom from XML page by specific code, using the algorithm Generate Text Fields.

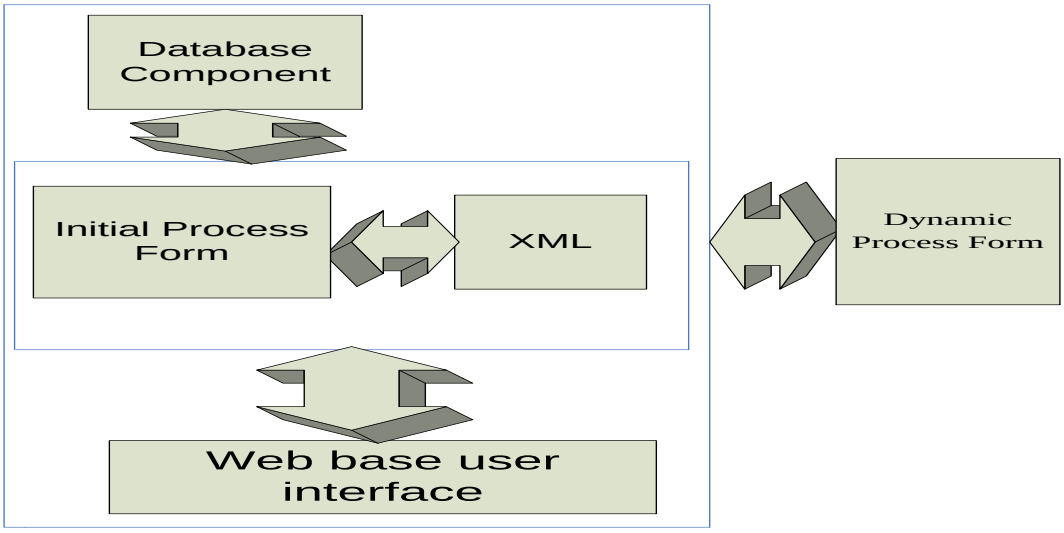

Figure-4.5 Generating Dynamic Process Form

```
public partial class Default3 : System.Web.UI.Page
{
    tblSaveTableAdapter tblSaveTA = new tblSaveTableAdapter();
    DataSet1.tblSaveDataTable tblSaveDT = new
DataSet1.tblSaveDataTable();

    protected void Page_Load(object sender, EventArgs e)
    {

        tblSaveDT = tblSaveTA.GetDataByID(22);

        string drboos = tblSaveDT.Rows[0][1].ToString();

           XmlDocument xmlData = new XmlDocument();

        XPathNavigator pXMLNavigator ;
        XPathNodeIterator pXMLIterator ;

        xmlData.LoadXml(drboos);
        pXMLNavigator = xmlData.CreateNavigator();

        pXMLIterator = pXMLNavigator.Select("EmpInfo/txtNo");
```

```
            pXMLIterator.MoveNext();
            txtNo.Value = pXMLIterator.Current.Value;


            pXMLIterator = pXMLNavigator.Select("EmpInfo/txtAge");
            pXMLIterator.MoveNext();
            txtAge.Value = pXMLIterator.Current.Value;

            pXMLIterator = pXMLNavigator.Select("EmpInfo/txtDept");
            pXMLIterator.MoveNext();
            txtDept.Value = pXMLIterator.Current.Value;

            pXMLIterator = pXMLNavigator.Select("EmpInfo/txtName");
            pXMLIterator.MoveNext();
            txtName.Value = pXMLIterator.Current.Value;

            pXMLIterator = pXMLNavigator.Select("EmpInfo/txtSalary");
            pXMLIterator.MoveNext();
            txtSalary.Value = pXMLIterator.Current.Value;


            for (int i = 1; i <= 4; i++)
            {
                pXMLIterator = pXMLNavigator.Select("EmpInfo/txt" +
i.ToString());
                pXMLIterator.MoveNext();
                div.InnerHtml += "<input runat='server' type='text'
name='txt" + i.ToString() + "' value='" + pXMLIterator.Current.Value +
"'>";

            }

            }
}
```

The generated dynamic process form will be stored in the Database as in figure 4.6.

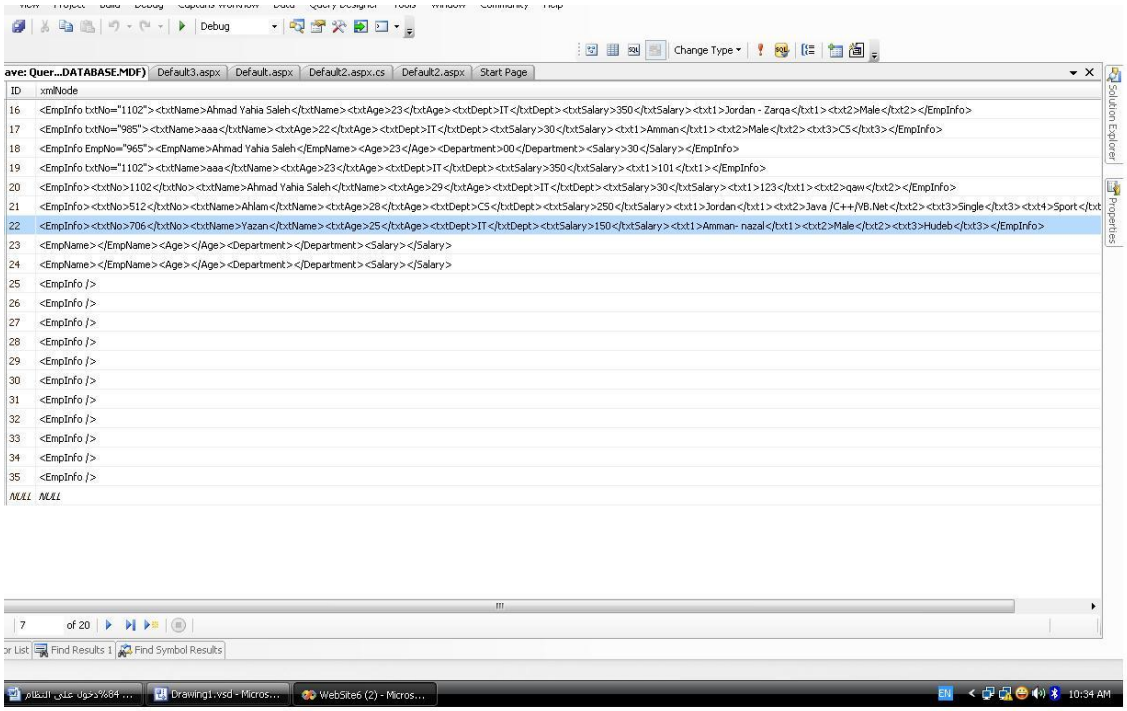

Figure-4.6 Saved XML in DBMS

Example for the how Represented text bottom from XML page by specific code**:**

```
<EmpInfo txtNo="1102">
    <txtName>Ahmad Yahia Saleh</txtName>
    <txtAge>23</txtAge>
    <txtDept>IT</txtDept>
    <txtSalary>350</txtSalary>
    <txt1>Amman</txt1>
    <txt2>Male</txt2>
  </EmpInfo>
```

C. Creation Dynamic activities.

This part is concerned with assigning the activities and their path to the users in order to generate the dynamic activities as seen in figure 4.7. Those users are the peoples who are involved in every activity; but, if any person does not exist in the database, the component will be added by the following statement.

If check _Exist (login Name) =true Then

Msg=”This is user Already Exit”

Else

Insert_ user (UserID, EmpName, LoginName, Password)

End IF

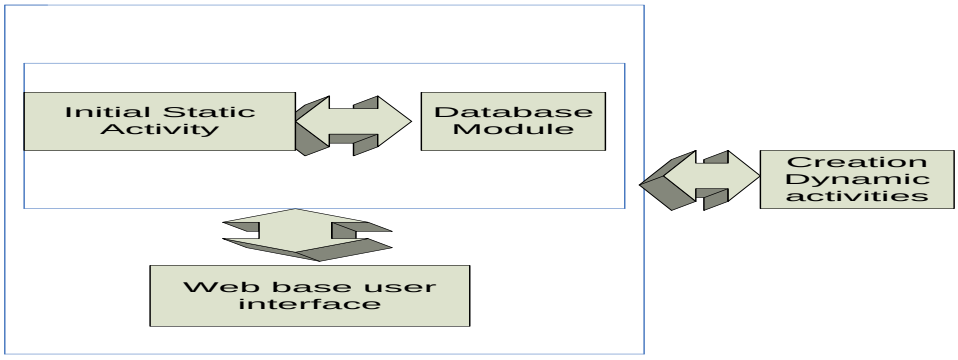

Figure-4.7Creation Dynamic activities

Authorized person (Manager or Administrator) retrieve the static activates from database then according to the requirements produced through the user interface then the dynamic activates will be generated. Through the dynamic activity creation processes, authorized person can assign the paths and users who are involved in any specific process and assign the flow sequence together with the date and time as shown in figure 4.8 they use the following statement.

```
For I as integer=0 to lbUserRole.item.count-1
UserID: lbUserRole.items (i).value
Insert_taskRoles (RoleID, TaskID, lbusersRole.item (i).value, RoleOrder, Status)
Status: =Initially=Null
Insert_ShowTask (ID, TaskID, lbuserRole.item (i).value, IsShow)
IsRead: Initially=False
```

The explanation of the above algorithm:

- There is an index for every user depends on the place in the list.
- lbUserRole.item.count: take the value of the first index in the list.
  UserID: lbUserRole.items (I).value: user value
- Depends on the place in list.
- Insert_taskRoles (RoleID, TaskID, lbusersRole.item (I). value, RoleOrder, Status: store in database server where it stores the RoleID, TaskID, and Path that the process will move on it.
- lbusersRole.item(I).value: store the type of process and the value of user depends to the list and Role Order , also it store the User ID and task status that means does the user open the task or not.

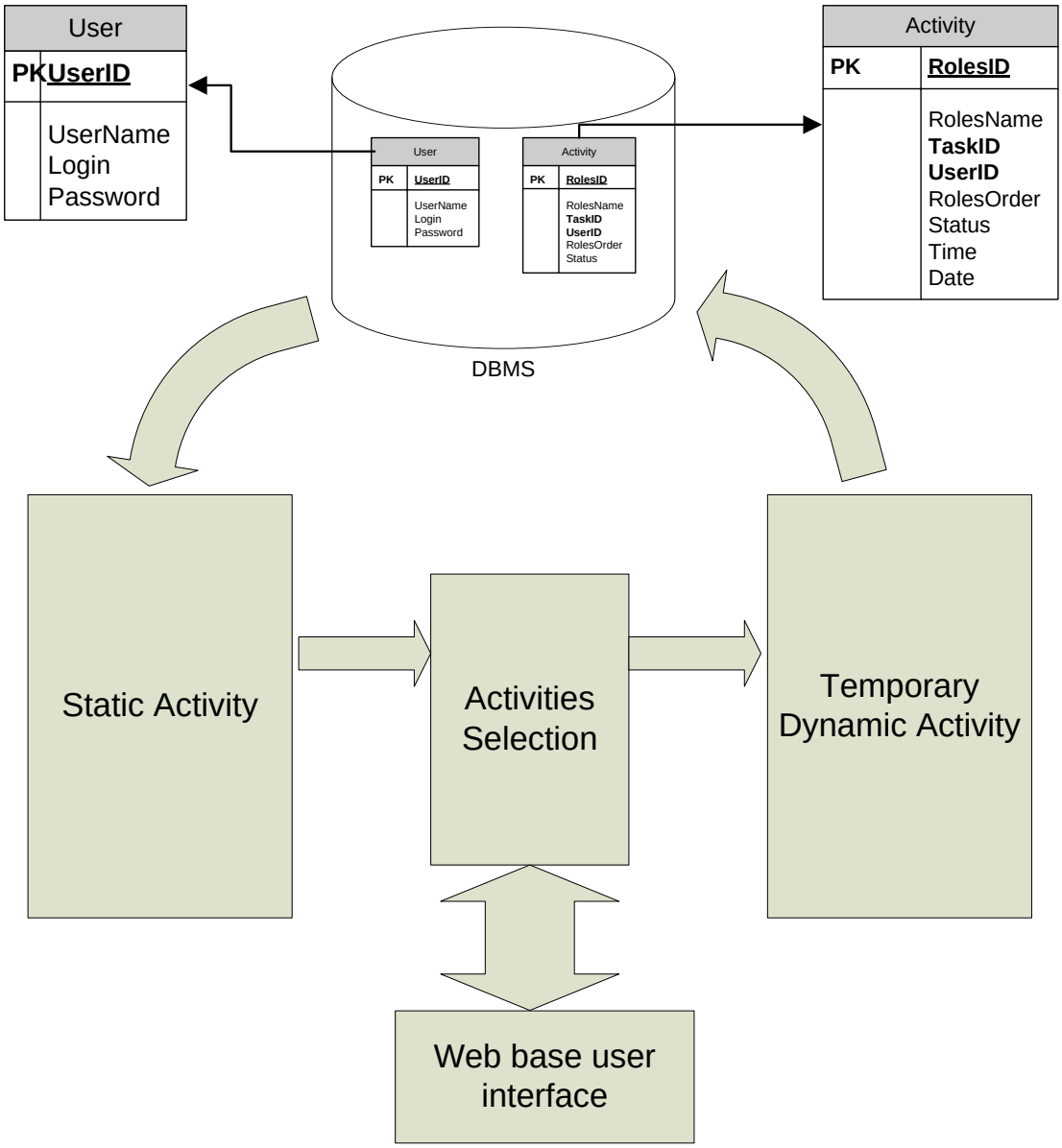

Figure-4.8 Creation Dynamic activities

4.2.2 Database Component

Using the Data Access Responses in order to initiates a connection between all component and Database by using ADO.Net as seen in figure 4.9.

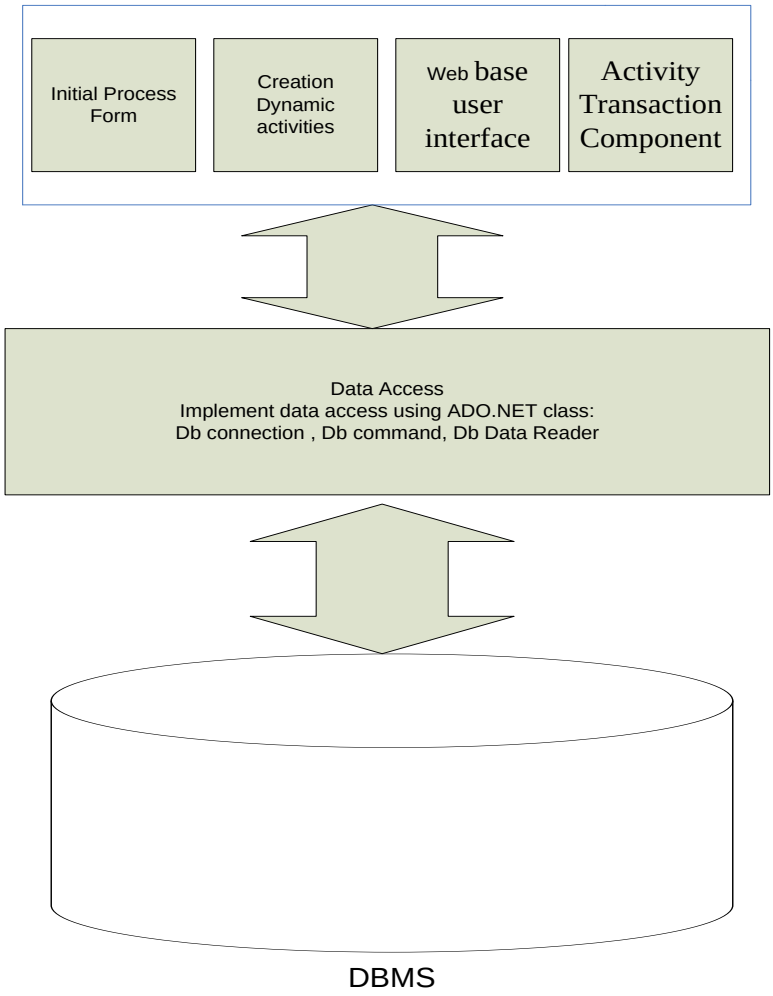

Figure-4.9 Database Component

Figure 4.10 presents the ER diagram for the tables used in the proposed system which consists of the following tables.

1. Dynamic activity table: It is the table that stores the value of path that is drawn from the first user and it contains the role name and number; it is stored in the sequence if the users move to them.

2. Process form Table: It stores the task ID and name and the name f initiator and all data are saved as XML.

3. Show task table: It stores the values that mention the status that are opened by user or not.

4. Static activity table: it is contains the users that involve in specific process.

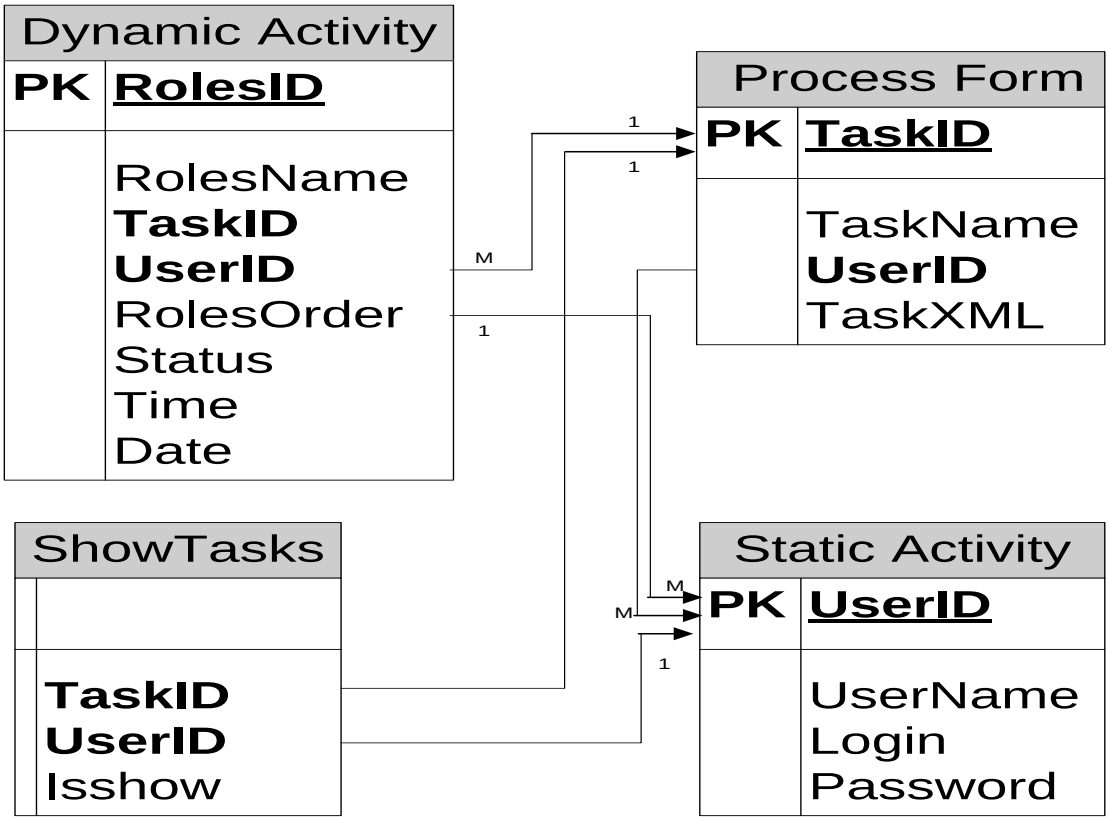

Figure-4.10 ER Diagram

4.2.3 Activity Transaction Component

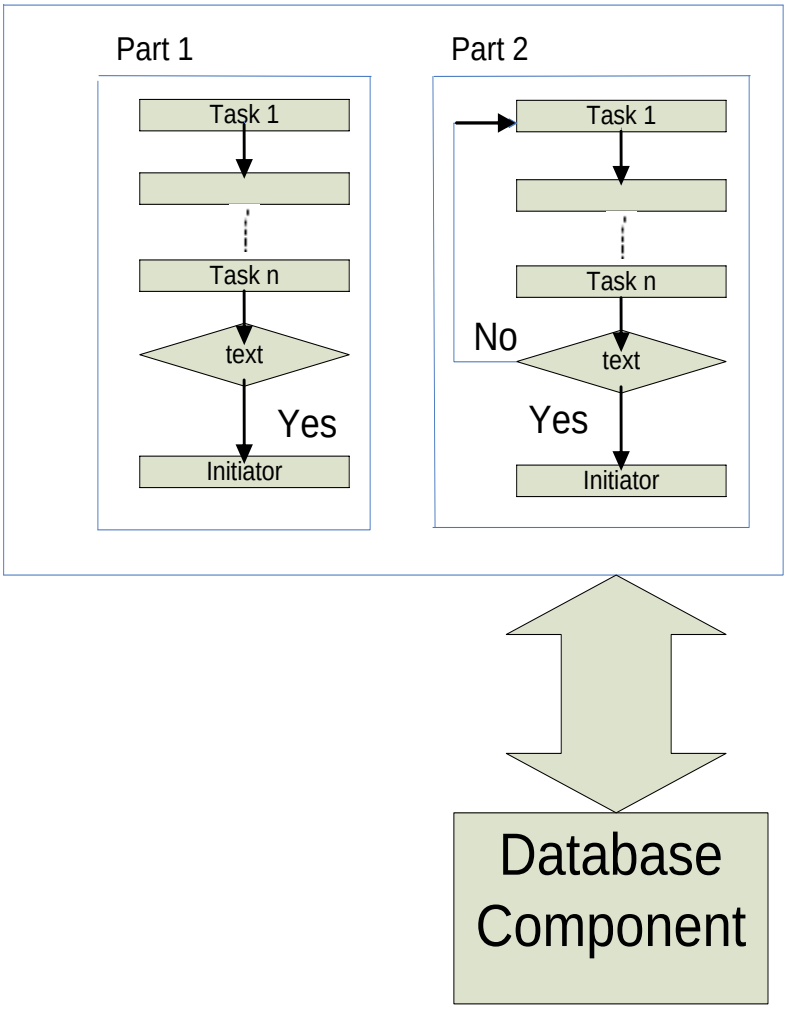

Figure-4.11 Activity Transaction Component

After the process build by authorized person, the process starts by moving to the first user who decides about the status by approving or rejecting and so on till the end of process path. If all users are agreed, it will be finished and returned to initiator by approving status as shown in Part (1). But if the process has any reject status, it will be returned to the initiation step to change and modify as request then resend it again to all users as shown in Part (2), it can be presented as If statement

IF (Task1^Task2^…. ^Taskn =”True”) Then
Return Initiator “Process successful Approval”

Else

(Task1^Task2^…. ^Taskn =”False”) Then

Return Initiator “Process Round 2”

And the below pseudocode clear the functionality:

User Receive Task

If Receive _Task (userid) =”get records” Then

{

Receive new task if status of current userid roleorder-1=True or False

  If show_task (taskid, userid) =True Then

 {

Update _show task (taskID, userID, True)

  Update show task isshow=True Where taskID and userID

    If Update_taskrole (taskid, userid, True) Then

 {

GO to Next user order in this task

    Else

    Go to next user order in this task and to user roleorder=0

  }

  End if

Return Receive _Task (Next User)

  Else

 Return show task (Waiting …..)

  End if

} End if

4.3 Demonstrating the Proposed Model

In this section, we demonstrate the proposed model through an example to show how the model works and how the data is transferred, we will explain this model through this example, by providing an employee a “cash advance”.

To clarify how this process works without electronic system, it often works as the following:-

Fill the specific paper form by requester with the information requirements as personnel information, salary, and others. After that the process moves starting by the direct manager approves for this request, then the process moves forward to complete the approval from relevant departments, as human resource officer then to finance officer and final to finance manager, everyone concern about relevant part, at the end, the applicant receives the final decision either by affirmative or with reject.

The following points are related to the path of this process:

1. The requester login to the screen by user name and password, then, access to specific profile and choose the process (request cash advance).

   The electronic form asks the user to fill some require fields and after finishing click submits, so, it will move directly to the direct manager.

2. The manager opens the system by his own user name and password; he will find all request that need to be approved; he can amend or edit the request and also can write in new text field if there is any note, and for sure in this case, the direct manager is the only one who can use the dynamic form, and he can use the request with more flexibility, then he chooses the user (managers, officers) who must approve this request.

3. The path of this process can be specified by only using two list boxes: the first one contains all employees in the organization and the second one is an empty

list boxes, the manager can choose from first list box once he clicks over any employee and then it directly moves to the second one, the list is formed (second list box) appear the relevant users in this process, in this way, the managers can draw the path of the process to specify how it will work.

4. After that, the manager will send this process for the user in the beginning of the second list, then, the moves to the second one and so on to reach the end; everyone will be approved with his own part when the process finishes, and the applicant will receive a notification either with acceptance or rejection.
5. If the request is rejected, the reason will appear; and the applicant can fix this reason and resend the request again to all relevant users; at the end, all approval must be done to move the process forward and accept the request, then the requester can take the “cash advance”.

- Dr. Hussein H. Owaied, Dr. Hazim A. Farhan, Yazan. W. Hudeib, "*Framework Model for Workflow Management System"* Send to the Journal of Computer Science.

Chapter Five

Conclusion and future work

5.3 Conclusion

Workflow Management System (WFMS) allows organizations to define and control the various activities associated with a business process. In addition, many management systems also give a business the opportunity to measure and analyze the execution of the process so that continuous improvement can be made. This thesis, presents many problems such as workflow adaptability, Standardizations, and Dynamic process together with the Dynamic activities. The proposed model will solve these problems through the three component proposed; Dynamic process component, Database component and Activities Transaction component. The proposed model of the WFMS works through the interaction with user using and the user interface that includes web base user interface as well contains login screen, after the user input his own user name and password. The problems associated with Static form and applications have been solved by proposed Generating Dynamic Process Form; also, the problems associated with the Static activity are solved by proposed Creation Dynamic activities.

5.4 Future Work

In order to get more benefits from this work in the business organization, the future work is:

1. Implementation of the proposal model, and design a questionnaire in order to ensure the motivation for the present work.

2. Making enhancement to the proposed model in order to be used in industry and instating of indicated business ; in this case, the workflow can produce flow

3. Proposed model after satisfying the previous points may be used for the strategic information system.

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