

SOFTWARE PROJECT MANAGEMENT AUTOMATION FOR OFFSHORE DEVELOPMENT (SOUL)



By

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(2003-NUST-BIT-32)

A project submitted in partial fulfillment of the requirements for the degree of

Bachelors of Information Technology
NUST Institute of Information Technology
National University of Sciences & Technology
Rawalpindi, Pakistan

(2007)

CERTIFICATE

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DEDICATION

In the name of Allah, the Most Gracious, the Most Merciful

To my dear parents
Especially to my Father

Acknowledgements

I am deeply beholden to my supervisor Mr. Atif Kamal for his continuous assistance, patience and inspiration. I am highly thankful to Dr. Arshad Ali for his valuable guidance and suggestions especially for the provision of all kinds of facilities throughout my thesis work.

I am highly grateful to Mr. Mujtaba Haider for his valuable supervision and support to perform such a valuable industry project. I truly admire his dedication to my project and for all the help and suggestions and guidance that he has offered. A great deal of my project has been possible because of him.

I would like to express my gratitude to Mr. Ali Tufail (Committee member), Ms. Sana Khaliq (Committee member) for their valuable implications and comments to improve the dissertation.

I am highly thankful to all of my teachers whom had been guiding me throughout my course work. Their knowledge, guidance and training enabled me to carry out this project. I would like to offer my thanks to all my course mates and university mates. I would like to express my gratitude for all my friends especially Mr. Sajjad Rizvi, Ms. Khadija Khan, and Ms. Rabail Javed for their moral support and help.

Abstract

Software industry has been facing problems relating quality assurance and time management since its birth. The main reason behind Software failure is lack of mathematical procedures. SOUL aims to provide a fully automated generic solution, which would help all software houses worldwide to track the Project progress and to monitor employee's performance on daily basis against specific project thus ensuring timely completion of the project ultimately resulting in increased profits.

SOUL comprises several small modules that would automate every process of a software house including Documentation, Resource Management, Quality Assurance and Quality Control, Project Initiation, Project Management, Project Estimation, Policy Management, Workflow control, Communication, etc. This will increase synergy between client and software house.

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Chapter 1

1. INTRODUCTION

1.1. BACKGROUND

Computer technology has become a household utility in modern era. Industry depends entirely on the computer technology for the execution and management of small and large operations despite the nature of business. Software technology has contributed in the field of Finances, Medical sciences, Management, Information Technology, Research, etc. With increasing business all around the globe, it becomes more difficult for companies to manage huge, complex data and resources. Therefore, companies are taking initiatives to automate entire working process. IT companies and software house are the real initiators in this regard.

This project will provide Project managers and clients with an interface to access and monitor the project work and the performance of the developers. Quality assurance and Quality control will be made easy by the progress and problem-tracking module. SOUL will provide accurate cost and time estimates for the project to reduce overwork and increase efficiency of employees by proper and continuous monitoring of the project progress through web based front-end modules. We intend to provide a generic solution for all project management institutions. The core objective is to optimize resource utilization and reduce communication time and cost which in turn

will increase the synergy between client and software house. The major areas of work include Project estimation, Document Management, User policy and rights, Security, Human Resource Management, Quality assurance and Reporting through web based front end.

1.2. Problem statement

Quality control and Quality assurance are two Key Success Factors in IT industry. Many standards have been proposed to assure quality and timely completion of projects. Computerizing the whole operational procedures and monitoring operations help the companies indefinitely to achieve their targets in time and ensure full quality at the same time. Many efforts have been made in this regard and have proven to be successful. The main problem with all the proposed automated solutions has been insufficient modules. No single solution addresses the whole functionality of a software company including software development, quality assurance, progress control, estimation, Resource management, etc. Therefore, this project intends to completely automate the working of a software house, especially the ones involved in offshore software development. Currently in software house, project management activities are performed manually, which requires a lot of paper work and wastage of time and cost. Another draw back of manual project management is wastage of time in communication with Client especially in case of offshore clients.

Cost and Time Estimation module is designed to propose precise cost and time estimates to ensure completion of project in time and within specified budget and to increase customer loyalty and trust. Quality Assurance module is designed to ensure quality standards so that project delivered is completely according to customer requirements and international standards. Human Resource Management module is designed to allocate resources needed for the project and to manage employee data. It is very critical for both the company and the customer to track the progress of the project and problems faced during the project if any. Reporting module is designed to generate different reports to track the progress of the projects and problems faced during its implementation. Reporting module will also enable the Manager to evaluate the performance of his / her team at any time. Document Management module is designed to manage project documents and generic templates. Policy Management module is designed to manage policy and rights for different users. Other modules including Program Manager, Project Proposal Specialist, Work Package Owner, Team Leader, Software Developer, and Client are integrated to develop a final automated solution for a client.

Work distribution among three group members is shown in the table below:

Name of Student	Module
Yasir Naveed Riaz	Estimation Engine, Quality Assurance, Human Resource Management, Reporting, Document Management, Policy Management.
Yasir Mehmood	Project Manager, Work Package Owner, Team Leader,

	Software Developer.
Yasir Zahoor	Program Manager, Project Proposal Specialist, Client, Time Log

Figure 1: Work Division

1.3. Motivation

IT business is at its boom in modern era and is projected that every thing would be computerized in near future. Computer applications will become table products very soon. This demands more research, IT companies and IT professionals. With this increasing competition for work, Quality and time have become two important factors for success. Complete control and infrastructure is needed to ensure quality and timely completion of the project.

The average company utilizes 4 to 5 percent of revenue on information technology where as IT related company utilizes more than 10 percent of revenue on information technology.

1.3.1. Software Failure

The failure of the project jeopardizes company's perspective. In fact IT failure can stunt economic growth and quality of life. Billions of dollars are wasted each year on bad software. Main reasons for this failure include:

- Inaccurate estimates
- Poor reporting of project's status
- Poor communication among customers, developers and users
- Poor project management

1.3.2. Market Awareness

All IT companies are striving hard to overcome these shortcomings and are involved in huge investments in this regard. SOUL addresses all these shortcomings at the same time. This may save IT companies from losing money and customers. The product can lead the IT market if able to address the above-mentioned issues.

1.3.3. Lack of Automation

No one solution yet provides solution to all project management problems faced by an IT organization. A single product with all necessary flavors to improve quality, project delivery, and efficiency will be highly appreciated in the market. A generic web-based solution like SOUL needs to understand the structure and work flow of an organization in order to produce more efficient results. Thus, efficient and a proper generic solution is required for the automation of an IT organization.

1.3.4. Importance of Project Management

Project Management has been contributing a lot in the economic growth of countries. Research of UK government's Department of Trade and Industry (DTI) [1] shows that innovative businesses are more successful and innovative industries grow faster, export more, are more competitive, more productive, and have a better long-term future. And by definition, innovation relies on Project Management. Thus a unique project management tool is essential to facilitate the innovate companies

Chapter 2

2. LITERATURE REVIEW

2.1. Estimation Models

2.1.1. COCOMO-I

Accurate cost and time estimate is crucial for timely completion of the quality software. COCOMO ("COConstructive COst MOdel") gives an estimate of the number of man-months it will take to develop a software product.

COCOMO consists of hierarchy of three forms. [2]

- Basic COCOMO - A single-valued model that computes software development effort (and cost) as a function of program size (lines of code)
- Intermediate COCOMO - computes software development effort as function of program size and a set of "cost drivers" that include subjective assessment of product, hardware, personnel and project attributes.
- Detailed COCOMO – Merger of Intermediate COCOMO and impact of cost drivers impact on each step (analysis, design, etc.) of the software engineering process.

There are three development modes:

Development Mode	Project Characteristics			
	<i>Size</i>	<i>Innovation</i>	<i>Deadline/constraints</i>	<i>Dev. Environment</i>
Organic	Small	Little	Not tight	Stable
Semi-detached	Medium	Medium	Medium	Medium
Embedded	Large	Greater	Tight	Complex hardware/customer interfaces

Figure 2: COCOMO Development Modes

2.1.2. COCOMO-II

COCOMO-II based on COCOMO-I appeared in 1991 [3] due to shift of software development technology from Mainframe and overnight batch processing to desktop development, code reusability, and the use of off-shelf software components. It provides 20 % cost and 70 % time estimate accuracy. The basic calculation in COCOMO-II model is the effort equation (to estimate number of Person-Months). COCOMO II focuses on issues such as non-sequential and rapid process development. COCOMO II provides classification of factors that can have influence on project cost. Many COCOMO II tools to calculate these parameters are already available in the market. SLOC is the fundamental step in cost estimation using COCOMO models.

2.1.2.1. Scale Factors

Scale Drivers is a concept used to find the complexity level of the project. Each scale driver has a range of rating levels, from Very Low to Extra High. Each rating level has a weight W and the value of the weight is called “Scale Factor”. Following table shows Scale Factors used in COCOMO II.[4]

W(i)	Very Low	Low	Nominal	High	Very High	Extra High
Precedentedness	4.05	3.24	2.43	1.62	0.81	0.00
Development Flexibility	6.07	4.86	3.64	2.43	1.21	0.00
Architecture / Risk Resolution	4.22	3.38	2.53	1.69	0.84	0.00
Team Cohesion	4.94	3.95	2.97	1.98	0.99	0.00
Process Maturity	4.54	3.64	2.73	1.82	0.91	0.00

Figure 3: COCOMO Scale Factors

2.1.2.2. Cost Drivers

COCOMO II has 17 cost drivers (multiplicative factors to determine effort required for the completion of the project) used to assess project, development, environment, and team to set each cost driver. Following table shows Cost drivers used in COCOMO II. [4]

Cost Driver	Rating					
	Very Low	Low	Nominal	High	Very High	Extra High
RELY	0.75	0.88	1.00	1.15	1.39	
DATA		0.93	1.00	1.09	1.19	
CPLX	0.75	0.88	1.00	1.15	1.30	1.66
RUSE		0.91	1.00	1.14	1.29	1.49
DOCU	0.89	0.95	1.00	1.06	1.13	
TIME			1.00	1.11	1.31	1.67
STOR			1.00	1.06	1.21	1.57
PVOL		0.87	1.00	1.15	1.30	
ACAP	1.50	1.22	1.00	0.83	0.67	
PCAP	1.37	1.16	1.00	0.87	0.74	
PCON	1.24	1.10	1.00	0.92	0.84	
AEXP	1.22	1.10	1.00	0.89	0.81	
PEXP	1.25	1.12	1.00	0.88	0.81	
LTEX	1.22	1.10	1.00	0.91	0.84	
TOOL	1.24	1.12	1.00	0.86	0.72	
SITE	1.25	1.10	1.00	0.92	0.84	0.78
SCED	1.29	1.10	1.00	1.00	1.00	

Figure 4: COCOMO Cost Drivers

2.1.2.3. Effort Equation

Effort is measured in Person Months. The fundamental factor on which this equation is based upon is Project Size (measured in thousands of SLOC, KSLOC). The effort equation used in COCOMO II is[5]:

$$\text{Effort} = 2.94 * \text{EAF} * (\text{KSLOC})^E$$

EAF is the Effort Adjustment Factor derived form Cost Drivers.

E is an exponent driver from the five scale Drivers.

2.1.2.4. Schedule Equation

Schedule equation determines the total number of months required to complete a project. Schedule equation used in COCOMO II is[5]:

$$\text{Duration} = 3.67 * (\text{Effort})^{SE}$$

Effort is the effort from Effort equation

SE is the schedule equation exponent derived from the five scale drivers.

2.1.3. SLIM

Putman's SLIM (Software Life Cycle Management) is an estimation model based on Norden/Rayleigh function. SLIM makes use of linear programming, statistical simulation, and program evaluation and review techniques to estimate cost. Following functions can be performed using SLIM [6]:

- Calibration: This involves the interpretation of the past projects data.
- Build: This involves collecting software characteristics, personal attributes, computer attributes, etc.

- Software Sizing: SLIM uses an automated version of lines of code (LOC) costing technique.

2.1.3.1. Algorithm

$$K = (\text{size}/(\text{CC} * \text{t}^{4/3}))^3$$

Size is the lines of code

K is the total life cycle effort (in working years)

T is development time (in years)

C is the Technology constant with values from 610 up to 57314.

2.1.3.2. Draw Backs

- SLIM is not suitable for small projects
- SLIM estimates are extremely sensitive to technology factors

2.1.3.2. Advantages

SLIM uses linear programming to consider development constraints on both cost and efforts.

2.1.4. Functional Point Analysis

An ISO recognized method to measure the function size of the system. Functional size is the amount of functionality ion the business. It is independent of the technology used to implement the system.

The unit of measurement is Function Point [7] and is used:

- To estimate application cost

- To estimate annual maintenance cost
- To estimate Project Productivity after its completion
- To determine software size for cost estimating

2.2. Quality Standards

2.2.1. Total Quality Management

Total Quality Management aims at embedding awareness of quality in all organizational processes. TQM has been widely used in manufacturing, education, government, and service industries. By the definition of ISO [8]:

“TQM is a management approach for an organization, centered on quality, based on the participation of all its members and aiming at long-term success through customer satisfaction, and benefits to all members of the organization and to society.”

2.2.1.1. Seven Tools of Quality

To improve Total Quality Management, several tools have been manufactured:

1. Ishikawa Diagram
2. Pareto Chart
3. Check Sheet
4. Control Chart
5. Flow chart
6. Histogram
7. Scatter Diagram

2.2.2. Six Sigma

A Motorola standard, asserts [9]:

- Continuous efforts to reduce variation in process outputs is key to business success
- Manufacturing and business processes can be measured, analyzed, improved and controlled
- Succeeding at achieving sustained quality improvement requires commitment from the entire organization, particularly from top-level management.

2.2.3. ISO

International Organization for Standardization is a non-governmental organization to set standards that often become law. There are 158 national members of ISO.

2.2.3.1. List of ISO Standards

ISO 1-ISO 999

ISO 1000-ISO 9999

ISO 10000-ISO 2999

2.2.4. CMMI

The Capability Maturity Model Integration (CMMI®) is an integrated model for systems and software engineering process improvement, integrated product and process development improvement and supplier sourcing. [10]

2.2.4.1. Five Key Concepts

1. **Consistency:** A continuous activity, which does not describe quality.
2. **Repeatable:** An IT activity that provides value and is followed by particular project team/group within the company.
3. **Transferable:** Its means that the activity is standardized and followed throughout the company.
4. **Quantitative:** It refers to measuring of an IT activity.
5. **Qualitative:** It refers to quality of the task.

2.2.4.2. CMMI Level

CMMI has six levels 0-5 to provide a measurement for organizations looking to improve their system development process.

1. **Level 0:** Not performed
2. **Level 1:** Performed Informally
3. **Level 2:** Planned and Tracked
4. **Level 3:** Well-Defined
5. **Level 4:** Quantitatively Controlled
6. **Level 5:** Continuously Improving

2.2.4.3. Numerous Processes

CMMI divides processes in four categories:

Category	Process	Maturity Level			
		2	3	4	5
Process Management	Organisational Process Definition		■		
	Organisational Process Focus		■		
	Organisational Training		■		
	Organisational Process Performance			■	
	Organisational Innovation and Deployment				■
Project Management	Project Planning	■			
	Project Monitoring and Control	■			
	Supplier Agreement Management	■			
	Integrated Project Management		■		
	Risk Management		■		
	Quantitative Project Management			■	
Engineering	Requirements Management	■			
	Requirements Development		■		
	Technical Solution		■		
	Product Integration		■		
	Verification		■		
	Validation		■		
Support	Configuration Management	■			
	Process and Product Quality Management	■			
	Measurement and Analysis	■			
	Decision Analysis and Resolution		■		
	Causal Analysis and Resolution				■

Figure 5: CMMI Numerous Processes

2.3. Project Management

2.3.1. Project Management Institute

PMI, incorporated in 1969, has published a number of standards related to Project Management and manages several layers of Project Management certifications. The standard Project Management Book of Knowledge (PMBOK) is the only ANSI standard for Project Management [11]. The levels of certifications are:

- Certified Associate in Project Management (CAPM)
- Project Management Professional (PMP)

2.3.1.1. Basic process groups

The standard Project Management Book of Knowledge (PMBOK) is the only ANSI standard for Project Management. The levels of certifications are:

The five basic process groups recognized by PMBOK® Guide are:

1. Initiating
2. Planning
3. Executing
4. Controlling and Monitoring
5. Closing

2.3.1.2. Knowledge Areas

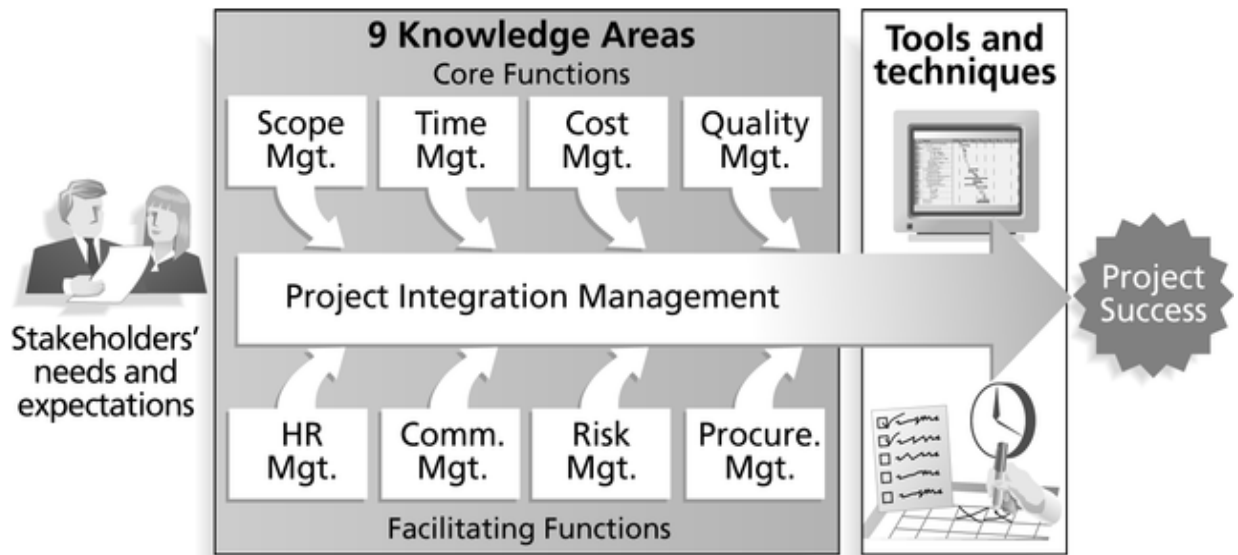


Figure 6: PMI Nine Knowledge Areas

2.3.1.2.1. Project Integration Management

- Project Plan Development
- Project Plan Execution
- Integrated Change Control

2.3.1.2.2. Project Scope Management

- Scope Planning
- Scope Definition
- Create WBS
- Scope Verification
- Scope Change Control

2.3.1.2.3. Project Time Management

- Activity Definition
- Activity Sequencing
- Activity Duration Estimating
- Activity Resource Estimating
- Schedule Development
- Schedule Control

2.3.1.2.4. Project Cost Management

- Resource Planning
- Cost Estimating
- Cost Budgeting
- Cost Control

2.3.1.2.5. Project Quality Management

- Quality Planning
- Quality Assurance
- Quality Control

2.3.1.2.6. Project Human Resource Management

- Human Resource Planning
- Acquire Team
- Develop Team

- Manage Team

2.3.1.2.7. Project Communications Management

- Communications Planning
- Information Distribution
- Performance Reporting
- Manage Stakeholders

2.3.1.2.8. Project Risk Management

- Risk Management Planning
- Risk Identification
- Qualitative Risk Analysis
- Quantitative risk Analysis
- Risk Response Planning
- Risk Monitoring and Control

2.3.1.2.9. Project Procure Management

- Procurement Planning
- Plan Contracting
- Request Sellers Response
- Select Sellers
- Contract Administration
- Contract Closeout

2.3.1.2.10. Knowledge Area Matrix

Project Management courses linked to the Nine Knowledge Areas as defined in PMI®'s <i>A Guide to the Project Management Body of Knowledge (PMBOK®)</i> .	Project Integration Management	Project Scope Management	Project Time Management	Project Cost Management	Project Quality Management	Project Human Resource Management	Project Communications Management	Project Risk Management	Project Procurement Management
Advanced Techniques for Enterprise Project Management	*	*	*	*	*	*	*	*	
Cost Estimating for IT Projects	*	*	*	*	*	*	*	*	
Defining and Managing IT Project Requirements	*	*		*	*	*	*	*	
Earned Value in Project Management	*	*	*	*			*	*	*
Federal Planning and Programming and the Exhibit 300		*	*	*	*		*	*	*
Integrated Cost and Schedule Control	*	*	*	*			*		
IT Project Risk Management	*		*	*	*	*	*	*	
Leadership and Communication Skills for Project Managers	*					*	*		
Managing Multiple Projects and Geographically Dispersed Projects	*	*	*	*		*	*	*	*
Managing Project Quality					*			*	
Managing Systems Integration Projects	*	*	*	*	*	*	*	*	*
Mastering IT Projects	*	*	*	*		*	*	*	
Mastering Organizational and People Issues on Projects (online)						*	*		
Mastering Project Requirements	*	*			*	*	*	*	
Mastering Technical Challenges and Issues on Projects (online)	*	*	*	*	*			*	*
Microsoft Project 2000	*		*	*			*		
PMP® Exam Review	*	*	*	*	*	*	*	*	*
PMP® Express: Certification Preparation	*	*	*	*	*	*	*	*	*
Project Management Essentials (online)	*	*	*	*	*	*	*	*	
Project Management Principles	*	*	*	*		*	*	*	
Project Management Simulation	*	*	*	*		*	*	*	
Project Procurement Management	*	*			*		*		*
Project Risk Management	*		*	*	*	*	*	*	
Software Project Management	*	*	*	*		*	*	*	
Software Quality Assurance	*	*		*	*				
Techniques for Successful Project Management	*	*	*	*	*	*	*	*	
The Project Management Office: Implementation and Function			*	*		*	*		

Figure 7: PMI Knowledge Area Matrix

Chapter 3

3. SYSTEM FEATURES

3.1. System Features

SOUL is an automated solution for software house based on project management procedures. Program Manager initiates the projects and sends a request for estimation to analysts/Sales tech. Program Manager prepares a proposal based on the provided estimate. Software process is followed to take approval from the customer. After approval, Project manager collects requirements, and asks Analysts/Sales Tech to come up with software documentations, like SRS, Use Case, etc. As soon as the requirement phase is completed, the Development team comes into action for development of the system. QA starts its operations as soon as Development team prepares one module or working part of the software. Team Lead for every department distributes tasks and work packages. QA issues Bug Reports and Progress reports to track the progress of project and employees performance. After successful completion of the project and customer approval, the project moves to close out phase, which is handled by Program manager.

3.1.1. Policy Management Module

Policy Management Module is responsible for Account Management. Only user with Administrator rights can use this module to manage user accounts and their

rights. This module controls the workflow and user actions according to rights given by administrator. Policy Management Modules include:

1. User creation (Customer and Employee)
2. User Edition
3. User Deletion
4. Rights Management (Group Based)

3.1.2. Document Management Module (DMM)

Document Management Module provides an interface to manage project and company documents. Based on rights set by Policy Manager, user could:

1. Upload Document / Template
2. Edit Document / Template
3. Delete Document / Template
4. Download Document / Template

User can use the available templates or add a new template to prepare a new document. Templates like SRS, Test Cases, Project Charter, Test Plan, Use Case, etc would be available and could be used for any project provided is the user is eligible to perform such action. New document would be added against selected project. DMM would check for the document. If the document were not available, DMM would upload the new document under the Project folder and set the version as 1.0. Otherwise, DMM would update the version History and would upload the document by appending the version at end.

3.1.3. Human Resource Management Module (HRM)

Two main functionalities of HRM would be:

1. Resource Allocation
2. Resource Record

Program Manager would send the request for resource allocation to HRM. HRM would check for the availability of resources from database on the basis of Resource Type (Equipment or human). In case of positive result, HRM would allocate resources and would confirm the allocation. But in case of negative result, HRM would perform no action and would notify the Program Manager and would ask him to place a request for new resource.

3.1.4. Estimation Module

Estimation Module is the implementation of COCOMO Model for estimation of cost and time. Program manager would send the request for project estimation along with necessary parameters like Cost Drivers. Based on these parameters, an automatic estimation result would be produced for the specific project and results would be displayed to the Program manager. Program Manager would use these results for further actions like proposal and Charter preparation, Resource Request, SRS Preparation and Project Monitoring.

3.1.5. Quality Assurance (QA) Module

Quality Assurance Module is implemented to monitor and control the quality of the project. QA module contains functionalities like:

1. Create, Delete, View Edit Task
2. Create, Edit, View, and Delete Bug
3. Run Progress and Bug Report for every project to track the Project Progress and Employees performance at the same time.

QA User would download the Project documents by using DMM. QA user would prepare test cases, test plan and other important documents for performing QA operations using available templates or by generating new templates through DMM. Reporting functionality would allow the Project Manager to view the performance of QA team and the project progress during QA phase. Client may also view the progress report and present status of the project via web interface based on rights.

3.2. Non Functional Requirements

3.2.1. User Interface

The User Interface needs to encompass all the user requirements. According to the requirements, it should support the following features.

- The user-interface shall be simple and easy to operate with proper error messages elaborating the causes of errors and avoiding any pitfalls.
- User shall be able to search for projects and respective documents.
- User shall be provided with an interface to download essential documents.
- An interface shall be provided for administrative purposes.
- Reports should be displayed in browser.
- Bugs shall be assigned by email.

3.2.2. System Requirements

The computer system on which the application is to run must have the following minimum specifications:

- Pentium III
- 256 MB RAM
- SQL Server
- Microsoft Visual Studio 2005

3.2.3. Performance Requirements

User Interface needs to encompass all the user requirements. According to the requirements, it should support the following features.

3.2.4. Security Requirements

User Interface needs to encompass all the user requirements. According to the requirements, it should support the following features.

Chapter 4

4. SYSTEM DESIGN AND ARCHITECTURE

4.1. System Design and Architecture

SOUL is divided in to three basic modules, which are further divided in to several modules:

1. Project Inception
2. Project Management
3. Project Closeout

SOUL will provide an infrastructure to automate a software house. In this regard, the project has been divided in to small modules. Program Manager will initiate the project. Analyst/Sales Tech would prepare initial Proposal/estimate. The proposal along with initial documents like Project Charter, Problem Statement, etc would be forwarded to Project Manager. On confirmation from Project Manager, Program Manager will draft the final proposal. Analysts/Sales Tech would do requirement Gathering and analysis. The project would enter the Implementation phase under the

supervision of Project Manager. This would include Resource Request, resource Acquisition, development, QA, changes and amendments and customer feed back. This cycle would continue until the completion of the project. Program Manager will close the project after successful completion in time.

4.1.1. ERD Diagram

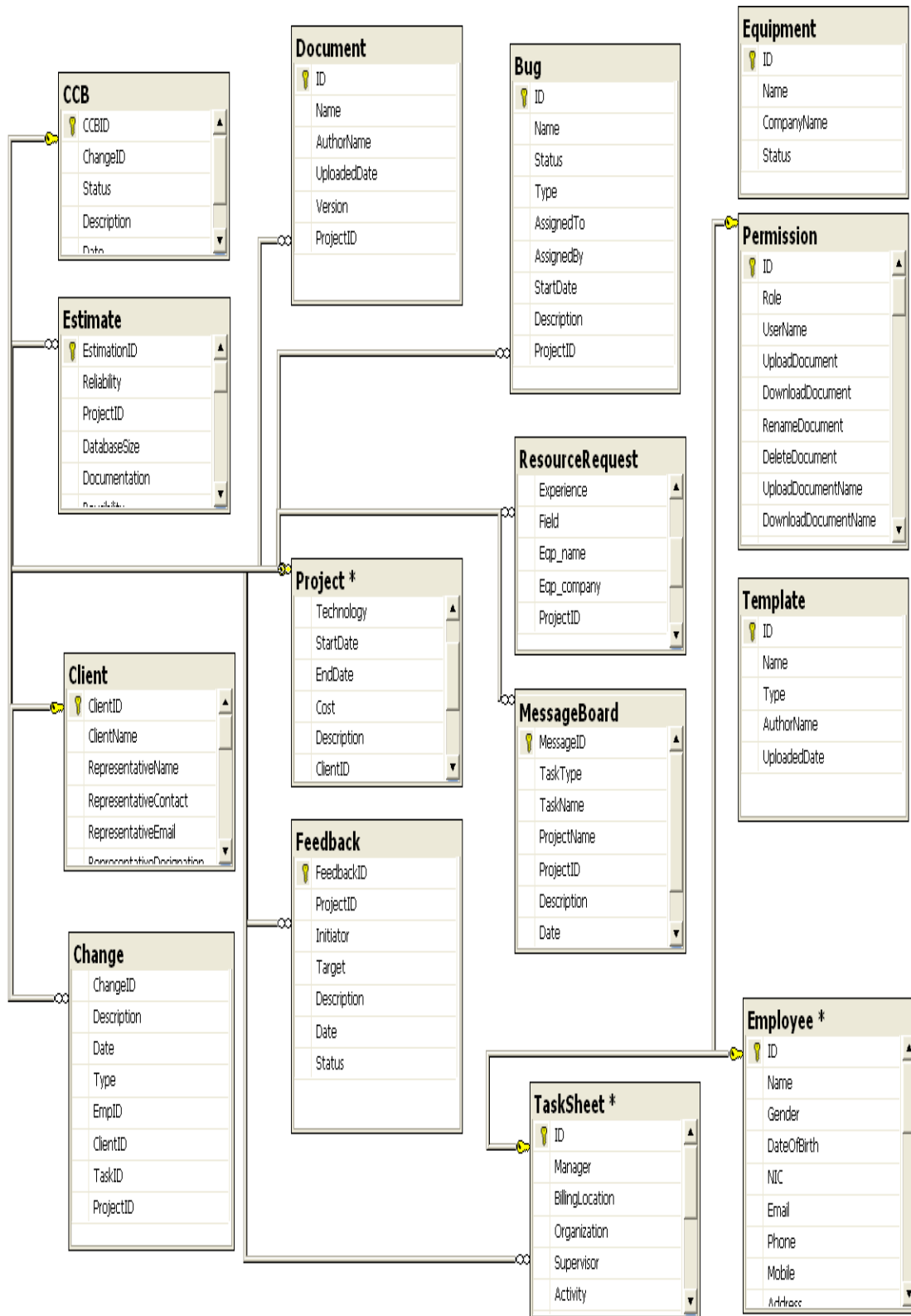


Figure 8: SOUL ERD

4.1.2. BLOCK Diagram

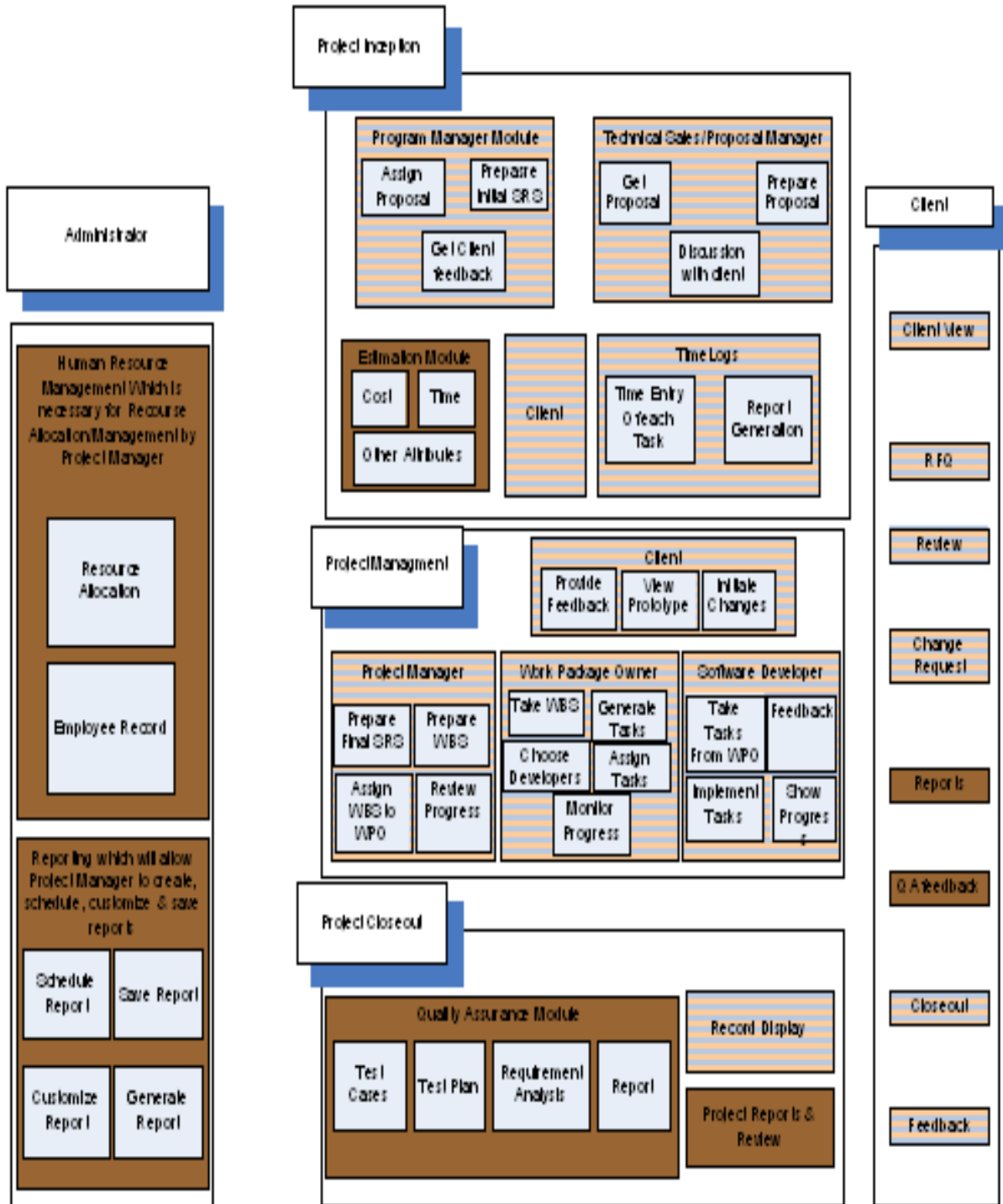


Figure 9: SOUL Block Diagram

4.1.3. SYSTEM ARCHITECTURE Diagram

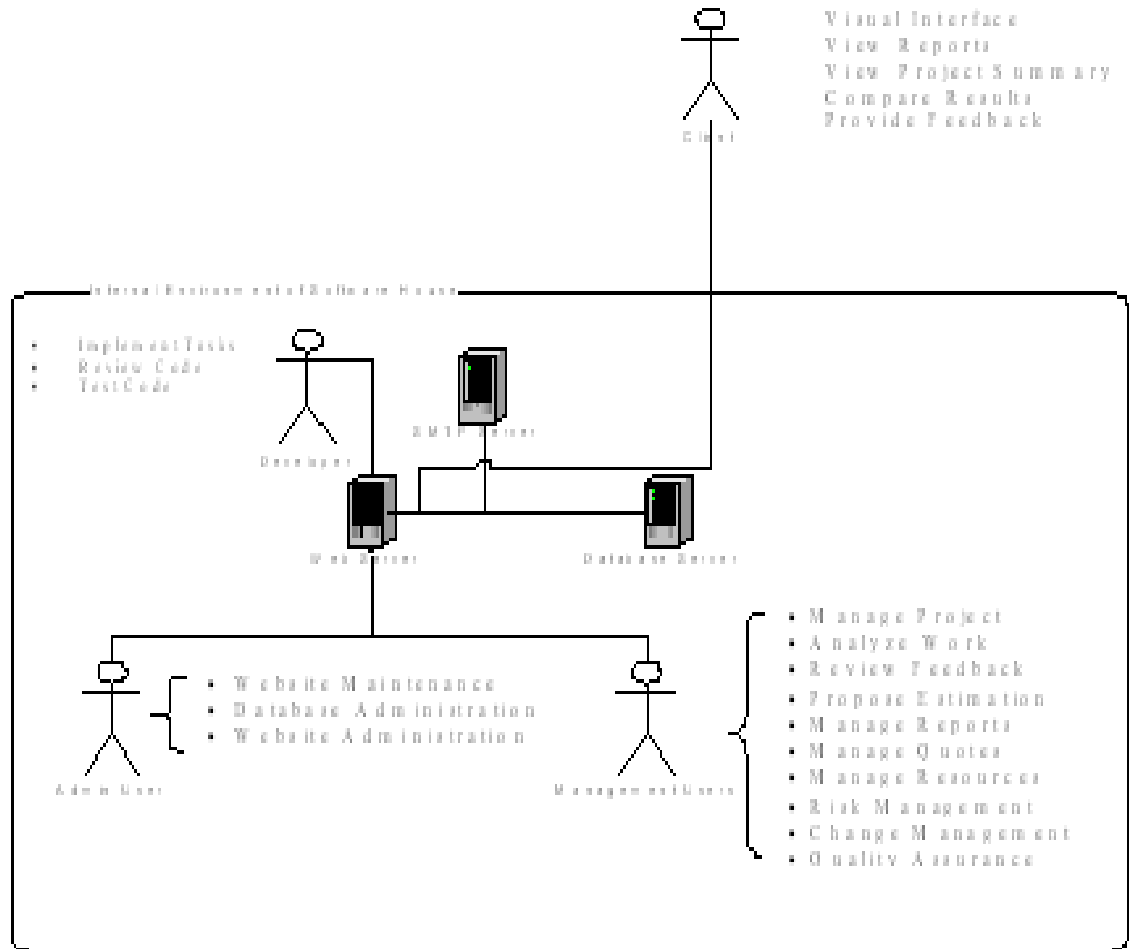


Figure 10: SOUL System Architecture Diagram

4.1.4. DFD Diagram

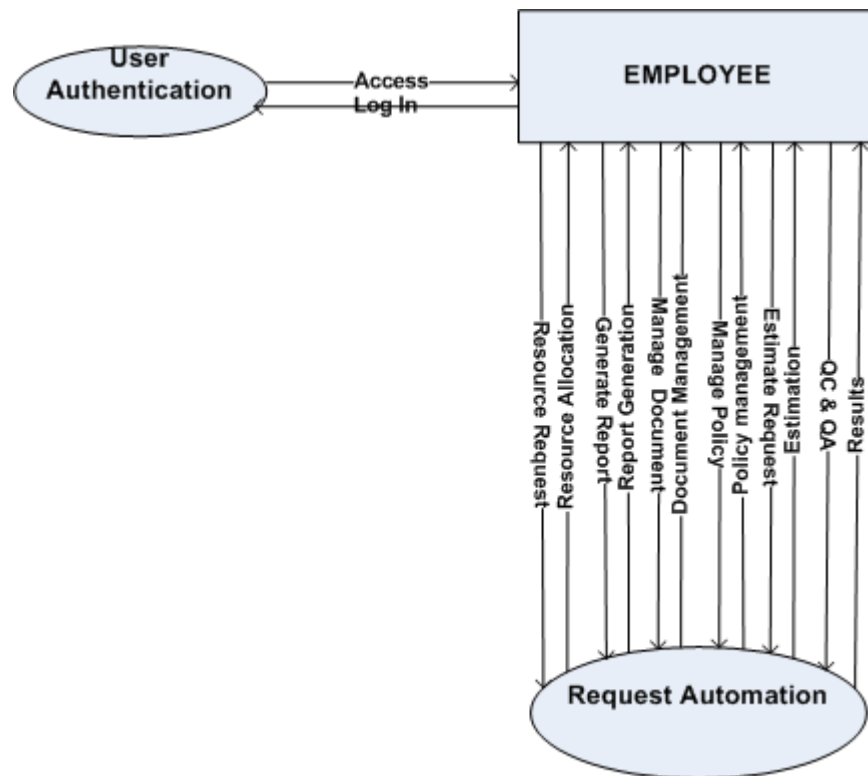


Figure 11: DFD Level 0

4.1.5. Use case Diagram

4.1.5.1. Use case 1: Manage Task

Use Case Name	1 Manage Task
Actors	QA Person
Description	This process will allow the user to create/edit daily tasks
Normal Course	<p>1 Click Task</p> <p>2 If user clicks on Date and no task is filled against that date, an interface opens where user enters his daily task against selected customer and project.</p>
Alternate Course	None
Pre Conditions	QA User must be logged in
Post Conditions	User clicks any other option than task.

4.1.5.2. Use case 2: Manage Bug

Use Case Name	2 Manage Bug
Actors	QA Person
Description	This process will allow the user to create/edit/delete bugs against any project.
Normal Course	<p>1 Click Bug</p> <p>2 If user clicks on Create Bug, system checks user right.</p> <p>2.1 If user has rights to create Bug, an interface opens where user enters information about the project, QA Person, Correspondent and the Bug.</p> <p>2.2 Else an error message is displayed.</p> <p>3 If user clicks on Edit Bug, system checks user right.</p> <p>3.1 If user has rights to Edit bug, an interface opens where</p>

	<p>user may alter the information.</p> <p>3.2 Else an error message is displayed.</p> <p>4 If user clicks on Delete Bug, system checks user right.</p> <p>4.1 If user has rights to Delete Bug, Bug is deleted from database.</p> <p>5 If user clicks on View Bug, system checks user right.</p> <p>5.1 If user has rights to View bug, an interface opens where user may alter the information.</p> <p>5.2 Else an error message is displayed.</p>
Alternate Course	None
Pre Conditions	QA User must be logged in
Post Conditions	User clicks any other option than Bug.

4.1.5.3. Use case 3: Manage Report

Use Case Name	3 Manage Report
Actors	QA Person / Project Manager
Description	This process will allow the user to create bug/progress report against any project.
Normal Course	<p>1 If user clicks Click Bug Report, A Bug report is generated and displayed in browser.</p> <p>2 If user clicks Click Progress Report, A Progress report is generated and displayed in browser.</p>
Alternate Course	None
Pre Conditions	<p>1 QA Person must be logged in.</p> <p>2 Project Manager must be logged in.</p>
Post Conditions	User clicks any other option than Bug Report and Progress Report.

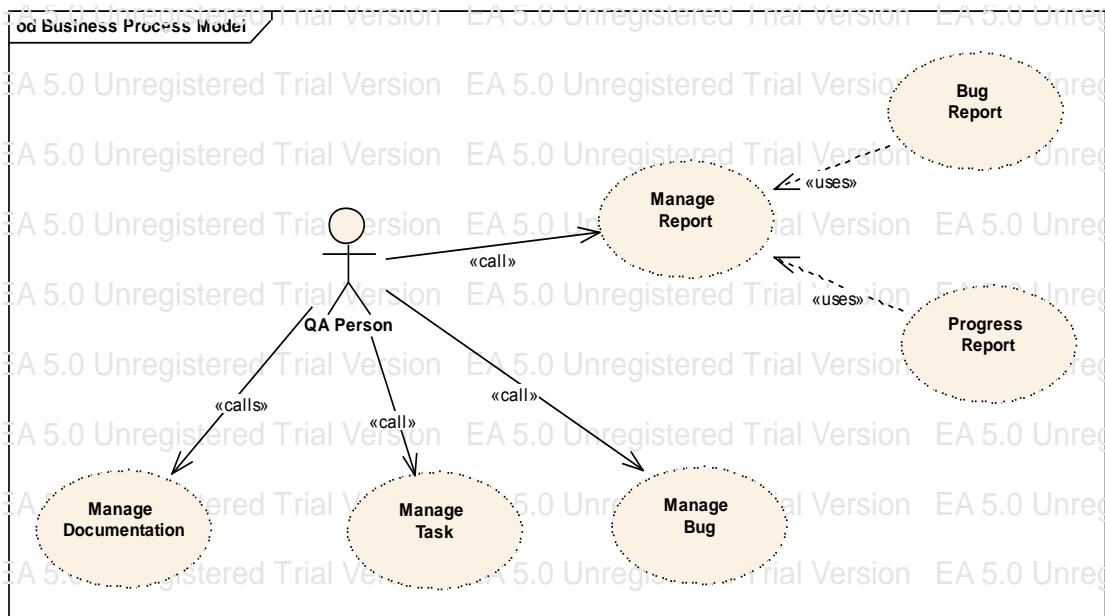


Figure 13: QA Use Case

4.1.5.4. Use case 4: Manage Documents / Templates

Use Case Name	4 Manage Documents
Actors	All Users
Description	This process will allow the user to upload/download and delete documents and templates.
Normal Course	<ol style="list-style-type: none"> 1 User selects type, Document or Template. 2. If user selects Document. <ol style="list-style-type: none"> 2.1 If user clicks Upload, system checks user right. <ol style="list-style-type: none"> 2.1.1 If user has rights to upload Document, User selects document and Project. <ol style="list-style-type: none"> 2.1.1.1 If any version of the document is already uploaded in the particular project folder, document is uploaded with new version. 2.1.1.1 If document is not uploaded before, System adds the

	<p>document with version set to 1.0.</p> <p>2.2 If user clicks Download, system checks user right.</p> <p>2.2.1 If user has rights to download Document, User selects document and Project.</p> <p>2.3 If user clicks Delete, system checks user right.</p> <p>2.3.1 If user has rights to delete Document, User selects document and Project.</p> <p>3 If user selects Template</p> <p>3.1 If user clicks Upload, System checks User rights.</p> <p>3.1.1 If user has rights to upload Template, user selects template and click upload.</p> <p>3.2 If user clicks Download, System checks for User rights.</p> <p>3.2.1 If user has rights to Download Template, user selects template and download.</p> <p>3.3 If user selects Delete, System checks for User rights.</p> <p>3.3.1 If user has rights to delete Template, user selects template and delete.</p>
Alternate Course	None
Pre Conditions	1 User must be logged in.
Post Conditions	User clicks any other option than Document from Main Menu.

4.1.5.5. Use case 5: Search Resources

Use Case Name	1 Search Resource
Actors	HR Person
Description	This process will allow the user to search resources (Human and Equipment)
Normal Course	<p>1 Receive Resource Request</p> <p>2 If Resource Type is Human, search in employee Record</p> <p>3 If Resource Type is Equipment, search in Equipment</p>

	Record.
Alternate Course	None
Pre Conditions	HR User must be logged in
Post Conditions	User logs off.

4.1.5.6. Use case 6: Allocate Resources

Use Case Name	2 Allocate Resource
Actors	HR Person
Description	This process will allow the user to search and allocate resources (Human and Equipment)
Normal Course	<ol style="list-style-type: none"> 1 Receive Resource Request 2 Use Search Resource Use case 3 Send results to request sender and update database. 4 If no match found or resources are unavailable, notify the request sender.
Alternate Course	None
Pre Conditions	User receives Resource Request.
Post Conditions	User sends results or User logs off.

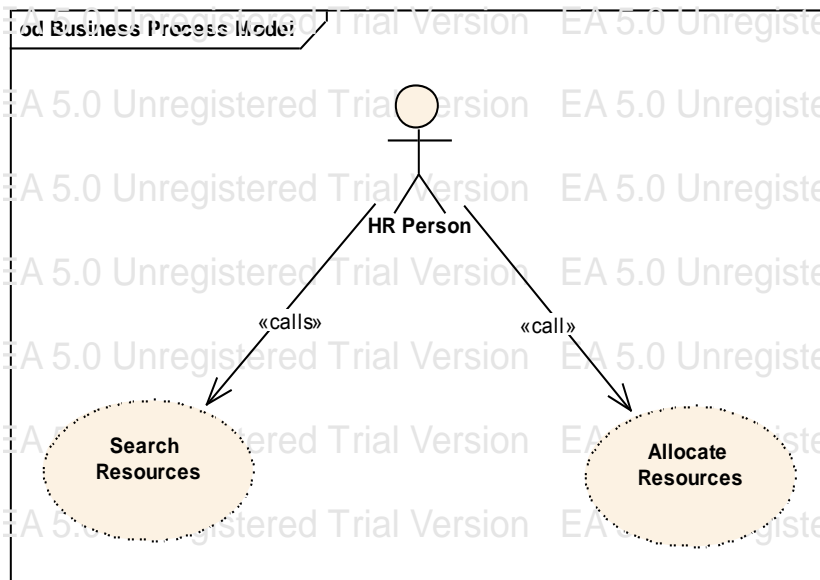


Figure 14: HR Use Case

4.1.5.7. Use case 7: Estimate Project

Use Case Name	1 Estimate Project
Actors	Analyst
Description	This process will allow the user to estimate for project.
Normal Course	<ol style="list-style-type: none"> 1 Receive Estimate Request 2 Search for parameters needed for estimates related to the particular project 3 Apply estimation algorithm 4 Display results
Alternate Course	None
Pre Conditions	User receives Estimation request
Post Conditions	User sends results or user logs off.

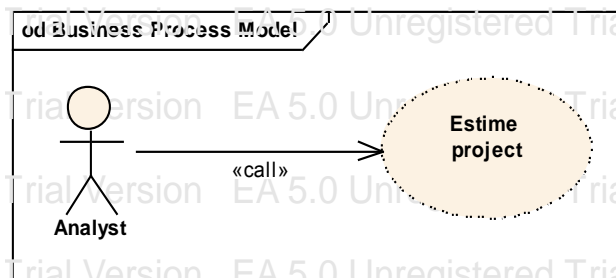


Figure 15: Estimation Use Case

4.1.5.8. Use case 8: Manage Users

Use Case Name	1 Manage Users
Actors	Administrator
Description	This process will allow the user to manage accounts.
Normal Course	<ol style="list-style-type: none"> 1 If User clicks Create Customer, an interface opens with Customer attributes. <ol style="list-style-type: none"> 1.1 If user clicks create, the data base is updated

	<p>1.2 See use case Manage Permissions</p> <p>2 If User clicks Edit Customer, an interface opens with Customer attributes.</p> <p>2.1 If user clicks Edit, the data base is updated</p> <p>2.2 See use case Manage Permissions</p> <p>3 If User clicks Create User, an interface opens with user attributes.</p> <p>3.1 If user clicks create, the data base is updated</p> <p>3.2 See use case Manage Permissions</p> <p>4 If User clicks Edit User, an interface opens with User attributes.</p> <p>2.1 If user clicks Edit, the data base is updated</p> <p>2.2 See use case Manage Permissions</p> <p>4 If User clicks Delete Customer, Customer record is deleted from database.</p> <p>5 If User clicks Delete User, User record is deleted from database.</p>
Alternate Course	None
Pre Conditions	1 User must be logged in.
Post Conditions	User logs off or clicks on any other option than User/Customer from Main Menu

4.1.5.9. Use case 9: Manage Permissions

Use Case Name	2 Manage Permissions
Actors	Administrator
Description	This process will allow the user to manage Permissions.
Normal Course	<p>1 User selects permissions against different categories</p> <p>2 User clicks Update.</p> <p>3 If Group assigned to user exists, there is no change in</p>

	<p>database</p> <p>4 If Group assigned to user does not exist, a new entry is added to database.</p>
Alternate Course	None
Pre Conditions	1 User must be logged in.
Post Conditions	User logs off or clicks on any other option than Permissions from Main Menu

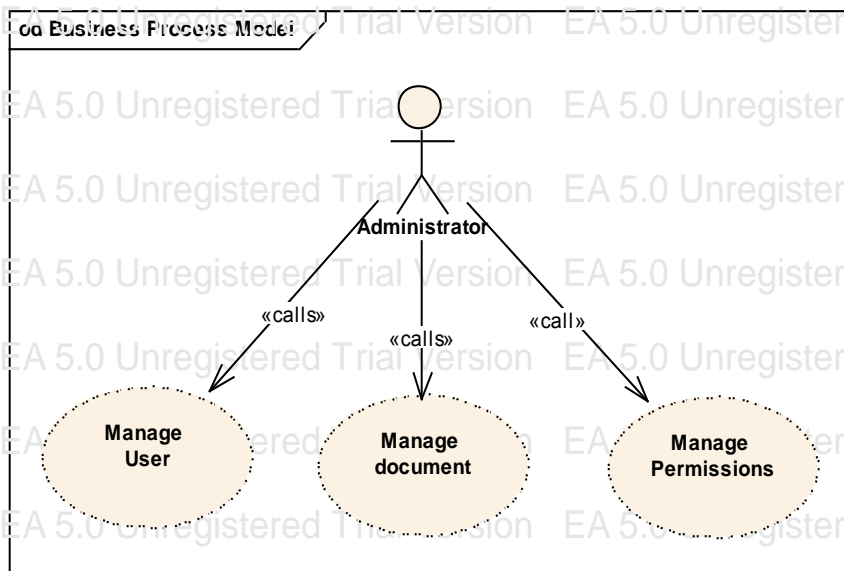


Figure 16: Policy Use Case

4.1.6. Sequence Diagram

4.1.6.1. Sequence Diagram 1: Manage Task

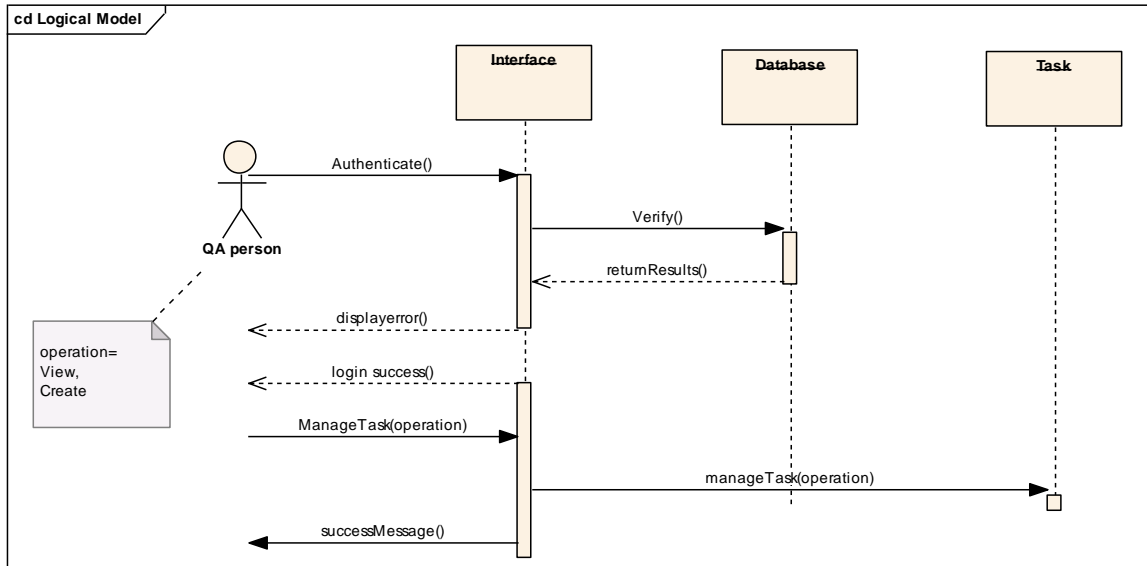


Figure 17: Sequence Manage Task

4.1.6.2. Sequence Diagram 2: Manage Bug

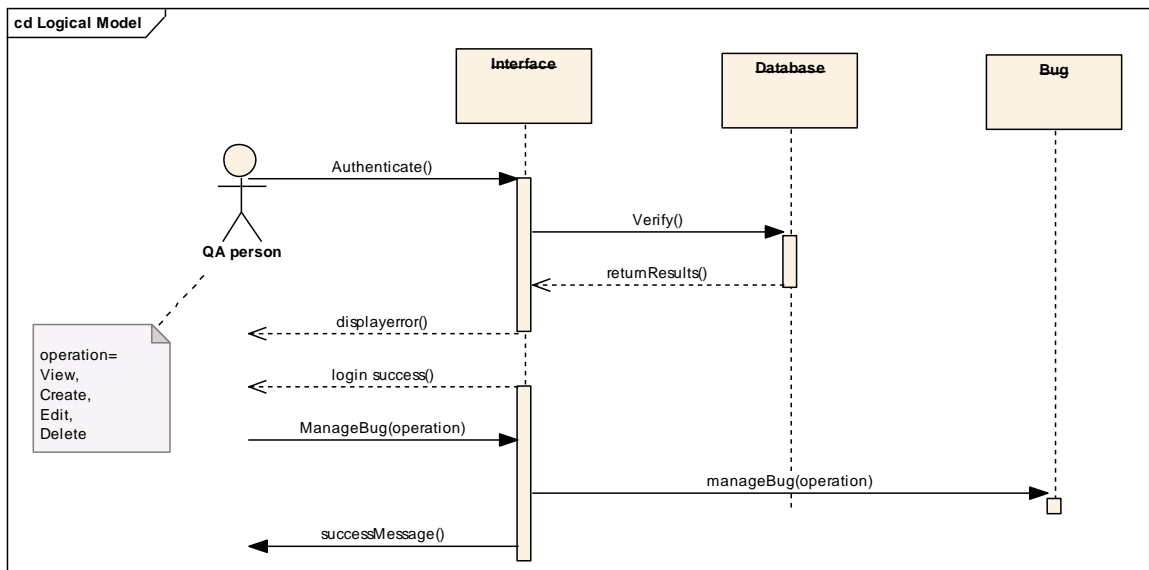


Figure 18: Sequence Manage Bug

4.1.6.3. Sequence Diagram 3: Manage Report

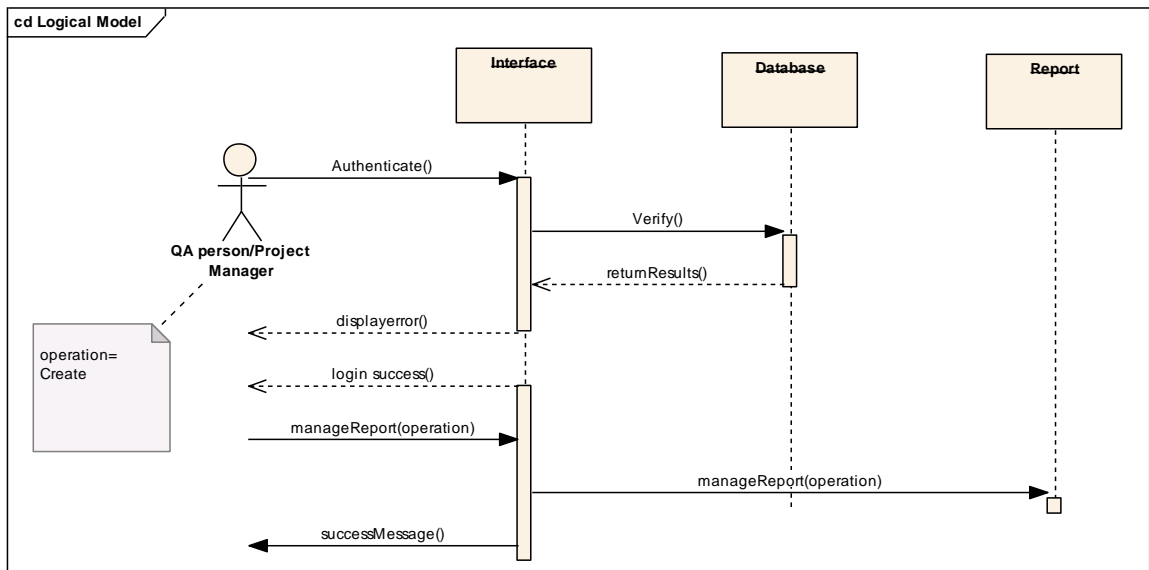


Figure 19: Sequence Manage Report

4.1.6.4. Sequence Diagram 4: Manage Document

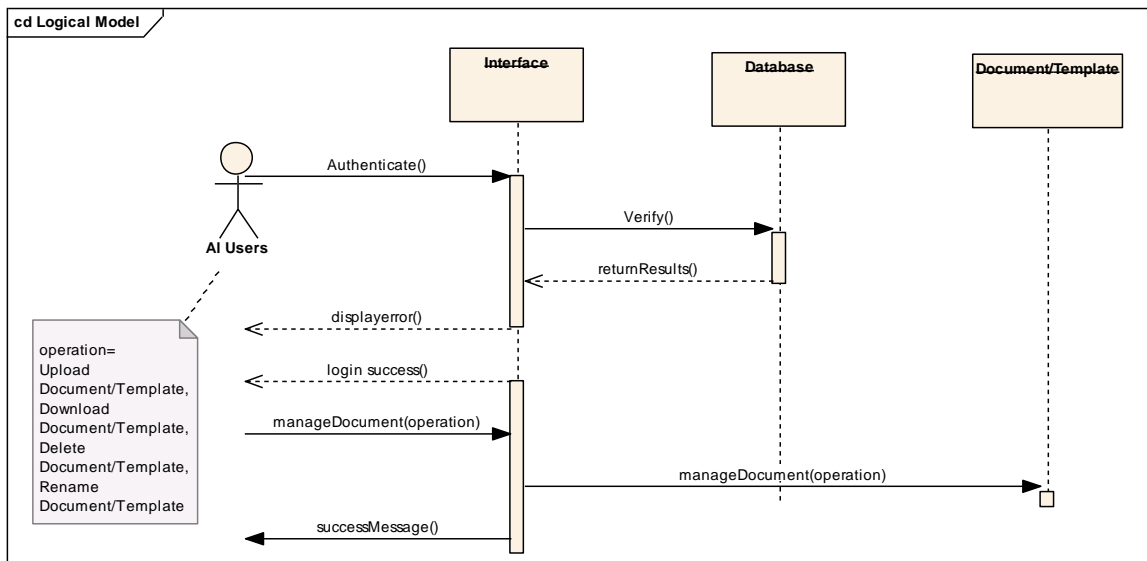


Figure 20: Sequence Manage Document

4.1.6.5. Sequence Diagram 5: Search Resource

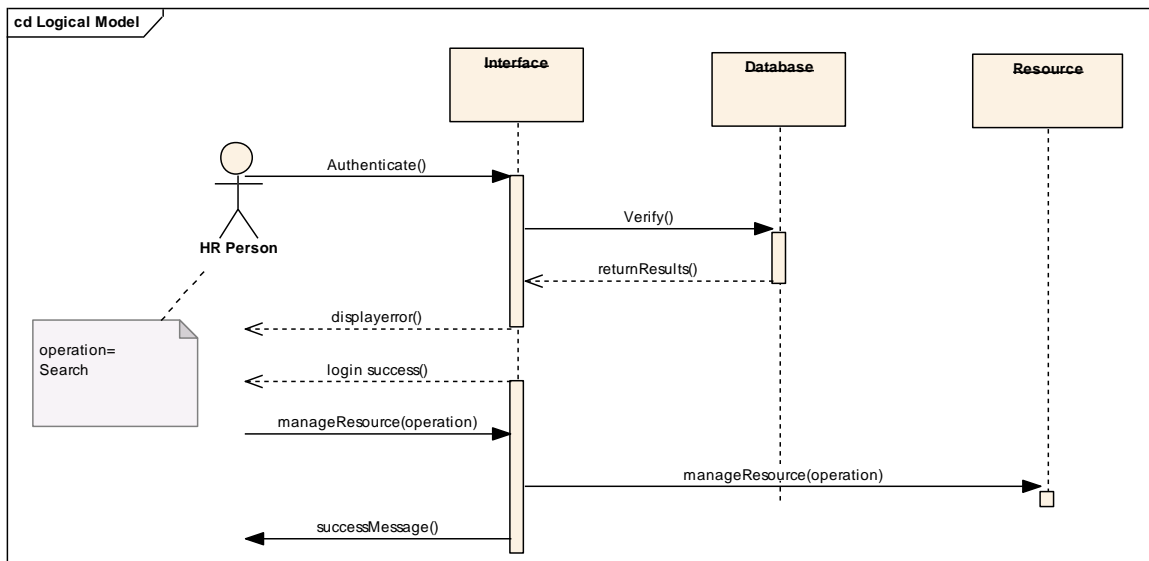


Figure 21: Sequence Search Resource

4.1.6.6. Sequence Diagram 6: Allocate Resource

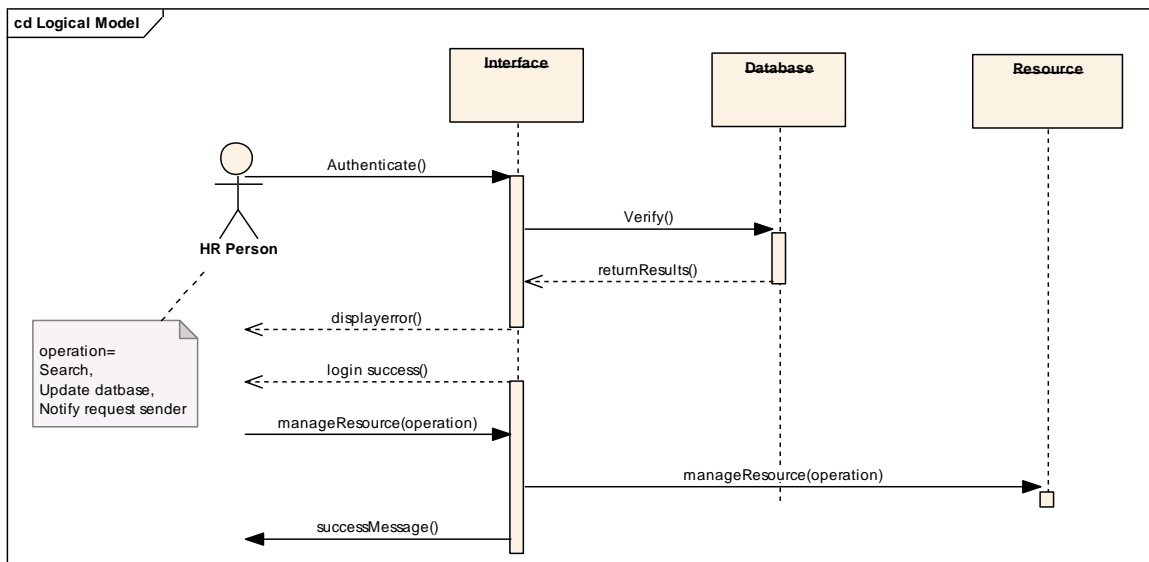


Figure 22: Sequence Allocate Resource

4.1.6.7. Sequence Diagram 7: Project Estimate

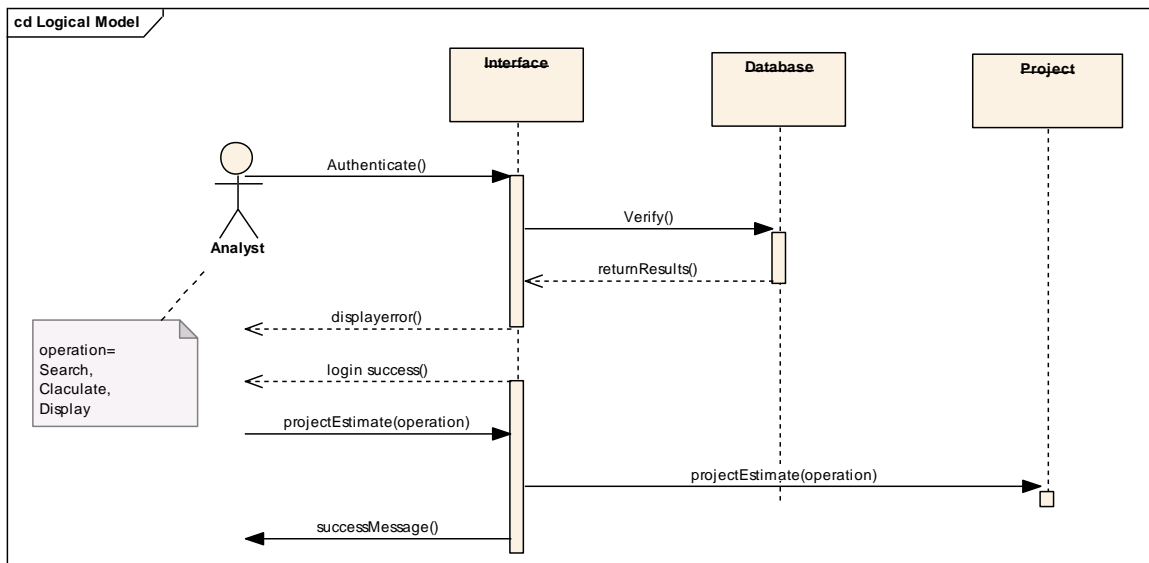


Figure 23: Sequence Project Estimate

4.1.6.8. Sequence Diagram 8: Manage Account

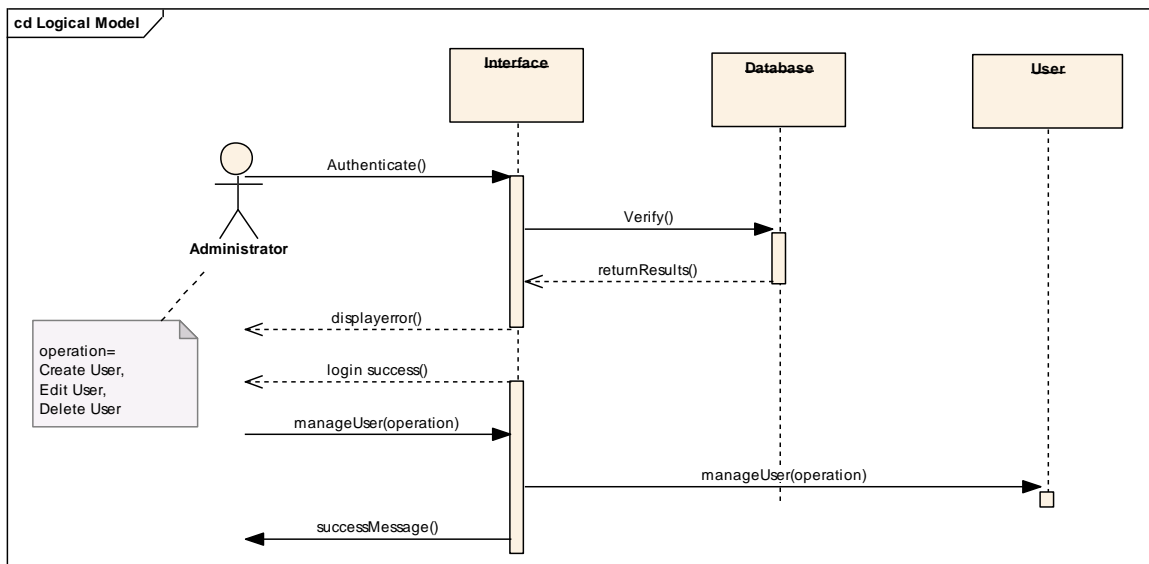


Figure 24: Sequence Manage Account

4.1.6.9. Sequence Diagram 9: Permissions

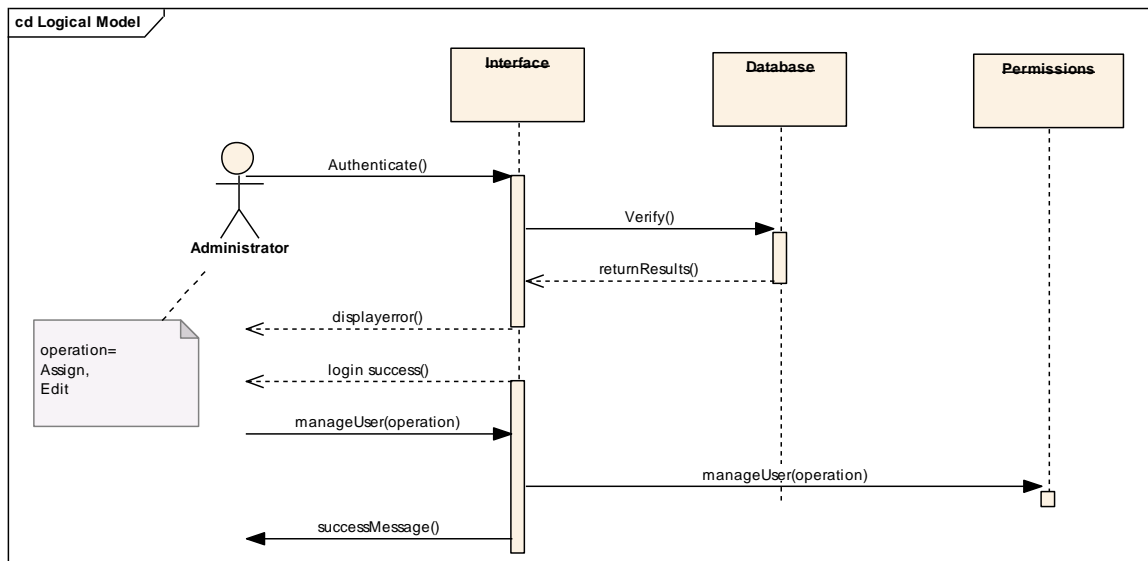


Figure 25: Sequence Permissions

4.1.7. Tools & Technologies

Following tools and technologies have been used as the development environment for the implementation of the project

- Microsoft Visual Studio.NET 2005
- Microsoft SQL Server 2005
- ASP.NET 2005
- C#. NET 2005

Chapter 5**5. TESTING****5.1. Test Cases**

Testing is an important and critical phase in software engineering. To verify the right working and integrity of a software house, careful testing is needed. This chapter explains the test used in the performance evaluation of SOUL.

5.1.1 Test Case 1: Database Connectivity Test

Purpose	To verify that the database connection is made without any error
Pre-requisite	Application must be loaded
Steps	1. Visit home page of SOUL
Verification	No database error

5.1.2 Test Case 2: User Authentication Test

Purpose	To authenticate the user
Pre-requisite	Application must be loaded
Steps	<ol style="list-style-type: none"> 1. Enter User name 2. Enter Pass word 3. Select Role 4. Click Log In
Verification	User logs in and gets no error if the user name and password matches the database

5.1.3 Test Case 3: Active User Test

Purpose	To verify that Inactive users are not authorized to log in
Pre-requisite	Application must be loaded
Steps	<ol style="list-style-type: none"> 1. Enter User name 2. Enter Pass word 3. Select Role 4. Click Log In
Verification	User does not logs in if his/her status is Inactive

5.1.4 Test Case 4: Policy Test

Purpose	To verify that Policy module is working fine
Pre-requisite	User must be logged in
Steps	1. Perform some un allowed action
Verification	User does nothing and displays privileges error

5.1.5 Test Case 5: Task Verification Test

Purpose	To verify the task is added against correct date and User
Pre-requisite	User must be logged in
Steps	1. Select Date 2. Enter Task Information 3. Click create Task
Verification	Click view task. Select User, and view task against the required date.

5.1.6 Test Case 6: Report Verification Test

Purpose	To verify that correct report is generated against every project
Pre-requisite	User must be logged in
Steps	1. Click Report Type against any project
Verification	Match the results with actual data

5.1.7 Test Case 7: Document Versioning Verification Test

Purpose	To verify the proper versioning of documents
Pre-requisite	User must be logged in
Steps	1. Select a new document to upload 2. Then select an existing document to upload
Verification	A new document is named with version 1.0 and an existing document is named by incrementing the previous version available

5.1.8 Test Case 8: Document Upload Verification Test

Purpose	To verify that document is uploaded on server at right location
Pre-requisite	User must be logged in
Steps	1. Select document and project
Verification	Check the project folder to verify the existence of the uploaded document

5.1.10 Test Case10: Document Deletion Verification Test

Purpose	To verify that document is deleted from server at right location
Pre-requisite	User must be logged in
Steps	1. Select document and project
Verification	Check the project folder to verify the non-existence of the uploaded document

5.1.10 Test Case 10: Navigational Verification Test

Purpose	To verify the proper navigation
Pre-requisite	User must be logged in
Steps	1. Click all links of different modules
Verification	On every click, the proper page opens up.

5.1.11 Test Case 11: Resource Verification Test

Purpose	To verify that Resource Module works fine
Pre-requisite	User must be logged in
Steps	1. Search Resource after selecting type 2. Send the results
Verification	Check if the right data is displayed for Resource type. If resource is unavailable, error should be displayed

5.1.12 Test Case 12: Estimation Test

Purpose	To verify that estimation modules shows correct behavior
Pre-requisite	User must be logged in
Steps	Send Estimation Request
Verification	Match the results with historical data

Chapter 6**6. IMPLEMENTATION****6.1. QA**

Quality Assurance Module is implemented to assure the control and tracking of software development process and employees performance. QA module interacts with Document Management Module to download, update/ delete documents and templates needed for the QA and QC process during the testing of any particular project. User may enter his/her daily task by selecting project and category. QA user may create/view/delete Bug against any project. Bus report based on the number of bugs of a particular user against a particular project is produced. Progress report is generated on the basis of Tasks completed by individual users.

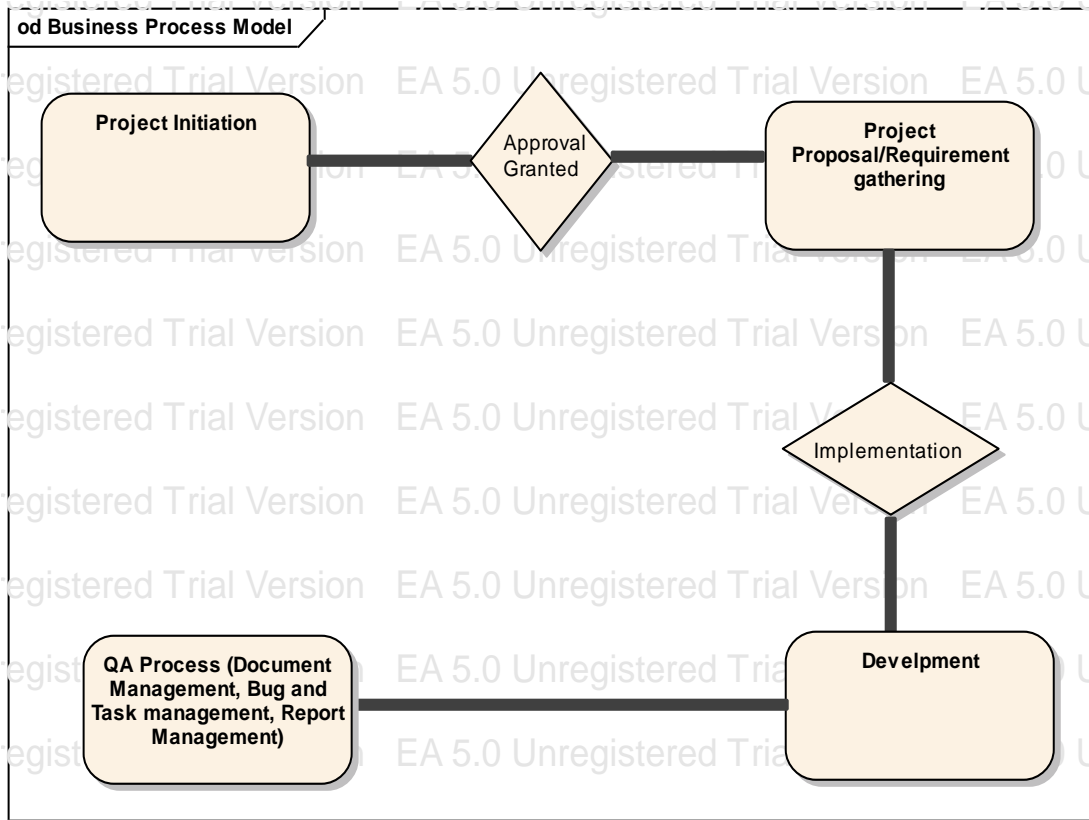


Figure 26: QA Workflow

6.1.1 QA Main Screen

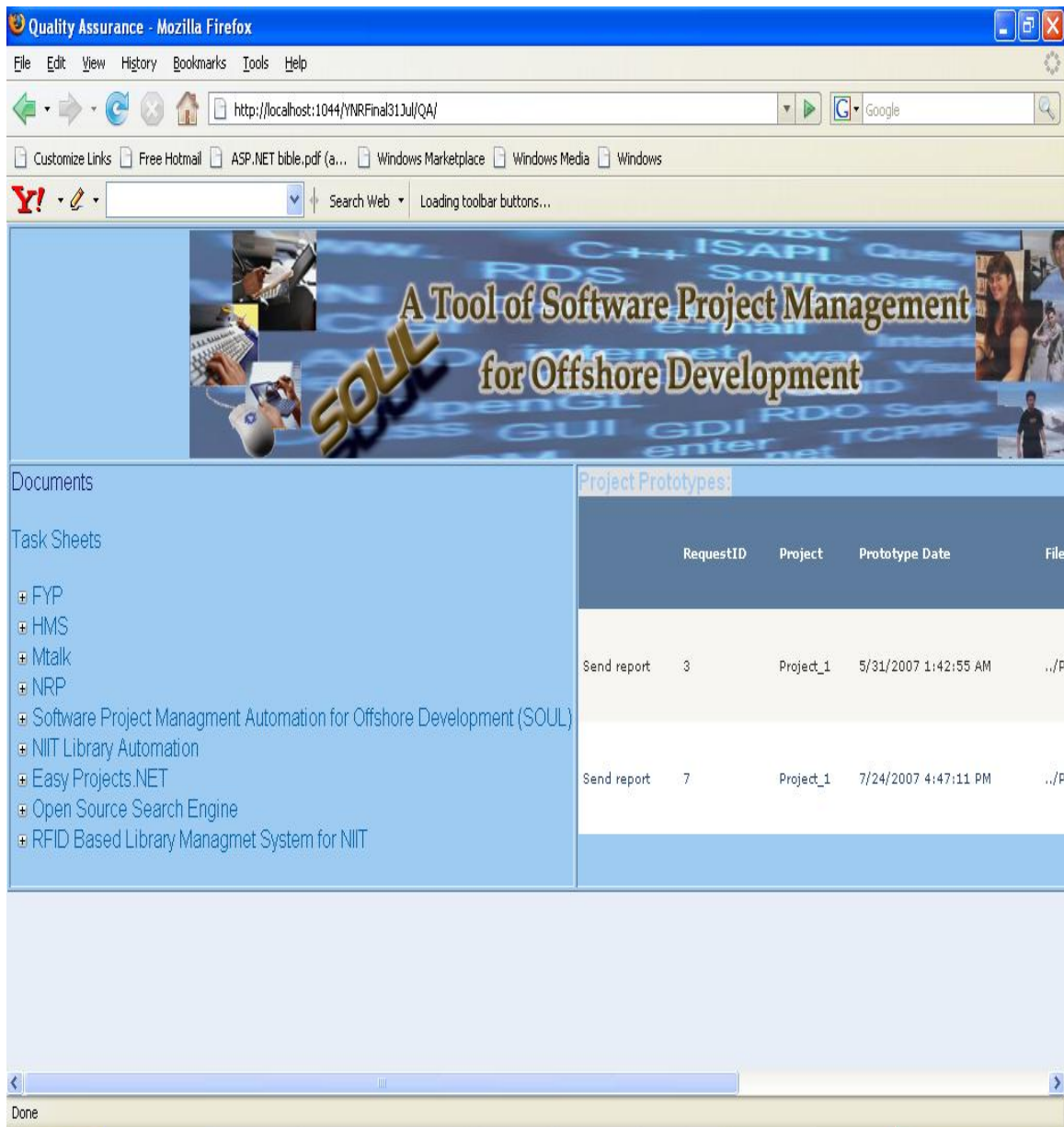


Figure 27: QA Main screen

6.1.2 Bug Report Screen

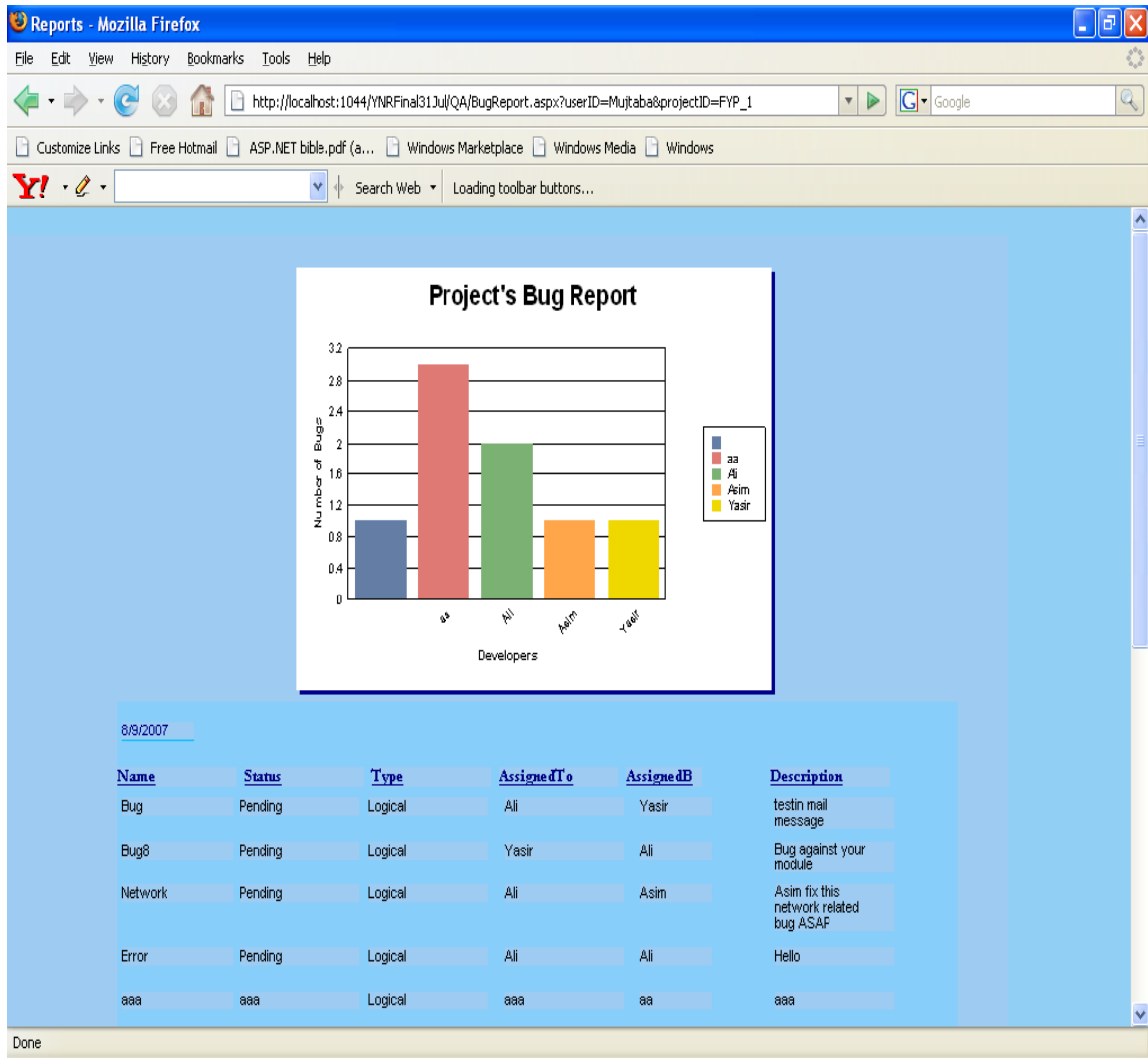


Figure 28: QA Bug Report screen

6.2. HR

HR module will receive the request from Program manager/Project Manager for resources allocation. A comprehensive search can be done on basis of resource type (Equipment or human). Results are sent back to the request sender.

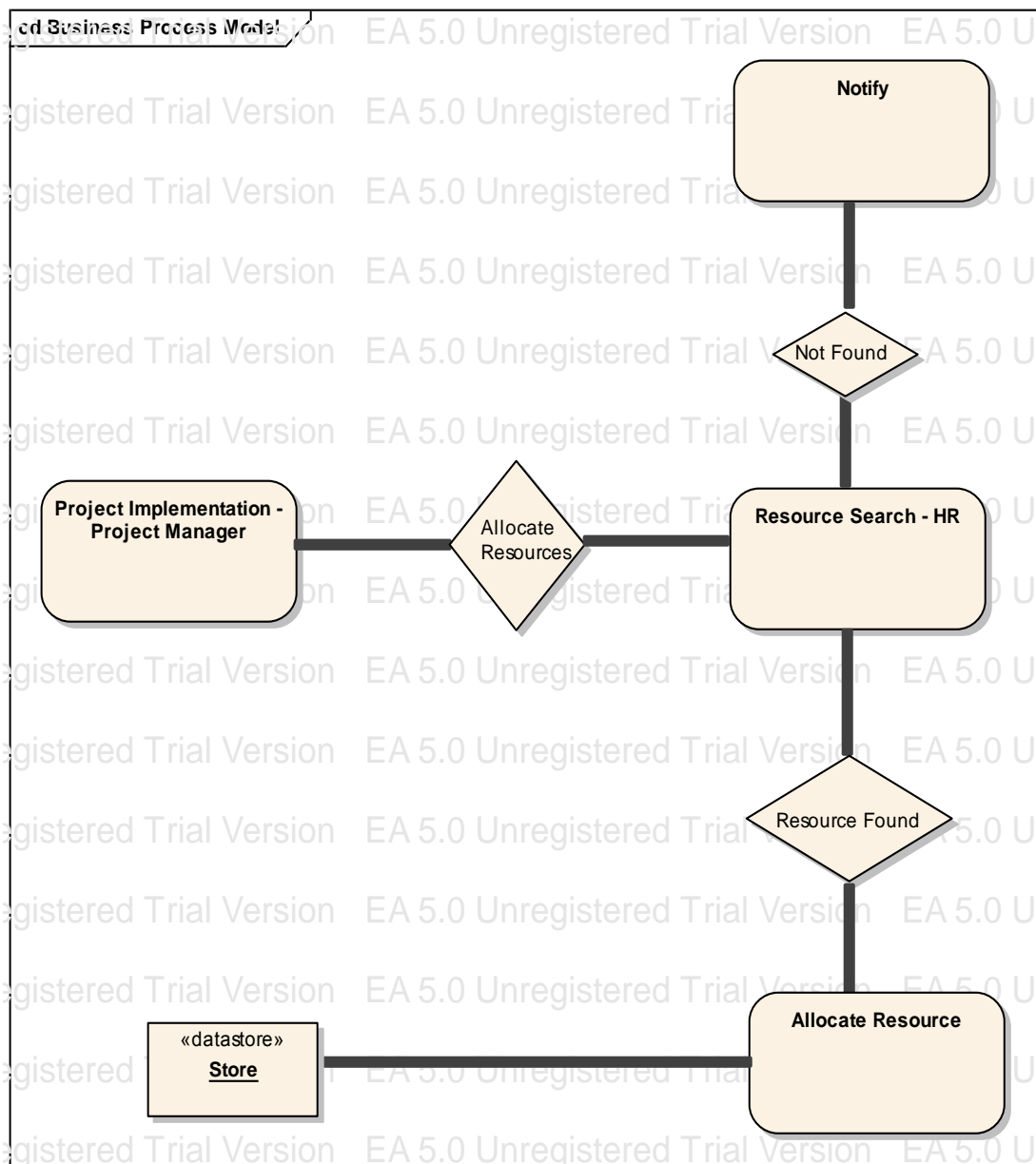


Figure 29: HR Workflow

6.2.1 Human Resource Request Screen

The screenshot displays a web application interface for HR requests. The browser window shows the URL `http://localhost:1044/YNRFinal313u/HR/`. The page features a navigation sidebar on the left and a main content area with two tables.

Human Resources Request:

Request ID	Resource Type	Required Date	Duration	Education	Experience	Expertise	Quantity	Project
12	Human	1/1/2007 12:00:00 AM			1	Java, SQL	5	
13	Human	6/21/2005 12:00:00 AM			2	Java	1	
14	Human	5/7/2007 12:00:00 AM			2	Java	5	
15	Human	2/12/2004 12:00:00 AM		BS(SE)	5	Java	2	
18	Human	7/20/2008 12:00:00 AM			5	Java	2	
19	Human	7/20/2007 12:00:00 AM			5	Java	2	
20	Human	7/10/2007 12:00:00 AM			5	Java	2	

Equipment Resource Request:

Request ID	Quantity	Project	Resource Type	Required Date	Duration	Company	Equipment
17	5		Equipment	2/12/2004 12:00:00 AM		Intel	Processor

Figure 30: HR Request screen

6.2.2 Equipment Resource Request Screen

The screenshot shows a Mozilla Firefox browser window displaying the HR Equipment screen. The browser's address bar shows the URL `http://localhost:1044/YNRFinal31Jul/HR/`. The page content includes a table of human resource requests and a section for equipment resource requests.

Human Resource Requests Table:

Request ID	Resource Type	Required Date	Duration	Education	Experience	Expertise	Quantity	Project
12	Human	1/1/2007 12:00:00 AM			1	Java, SQL	5	
13	Human	6/21/2005 12:00:00 AM			2	Java	1	
14	Human	5/7/2007 12:00:00 AM			2	Java	5	
15	Human	2/12/2004 12:00:00 AM		BS(SE)	5	Java	2	
18	Human	7/20/2008 12:00:00 AM			5	Java	2	
19	Human	7/20/2007 12:00:00 AM			5	Java	2	
20	Human	7/10/2007 12:00:00 AM			5	Java	2	

Equipment Resource Request:

Request ID	Quantity	Project	Resource Type	Required Date	Duration	Company	Equipment
17	5		Equipment	2/12/2004 12:00:00 AM		Intel	Processor

Figure 31: HR Equipment screen

6.3. Document Management

Document management module is designed to manage company's internal documents and documents against every project. Every user may access this system based on his/her privileges. User may select type of document to manage. User is allowed to update, rename, download and delete documents.

In case of update, automatic versioning component is designed to avoid same documents name for more than one document. No versioning is handled in case of template. Templates may include any type of document like Test Plan, Test Cases; use Cases, Project Charter, SRS, QC Check list, etc.

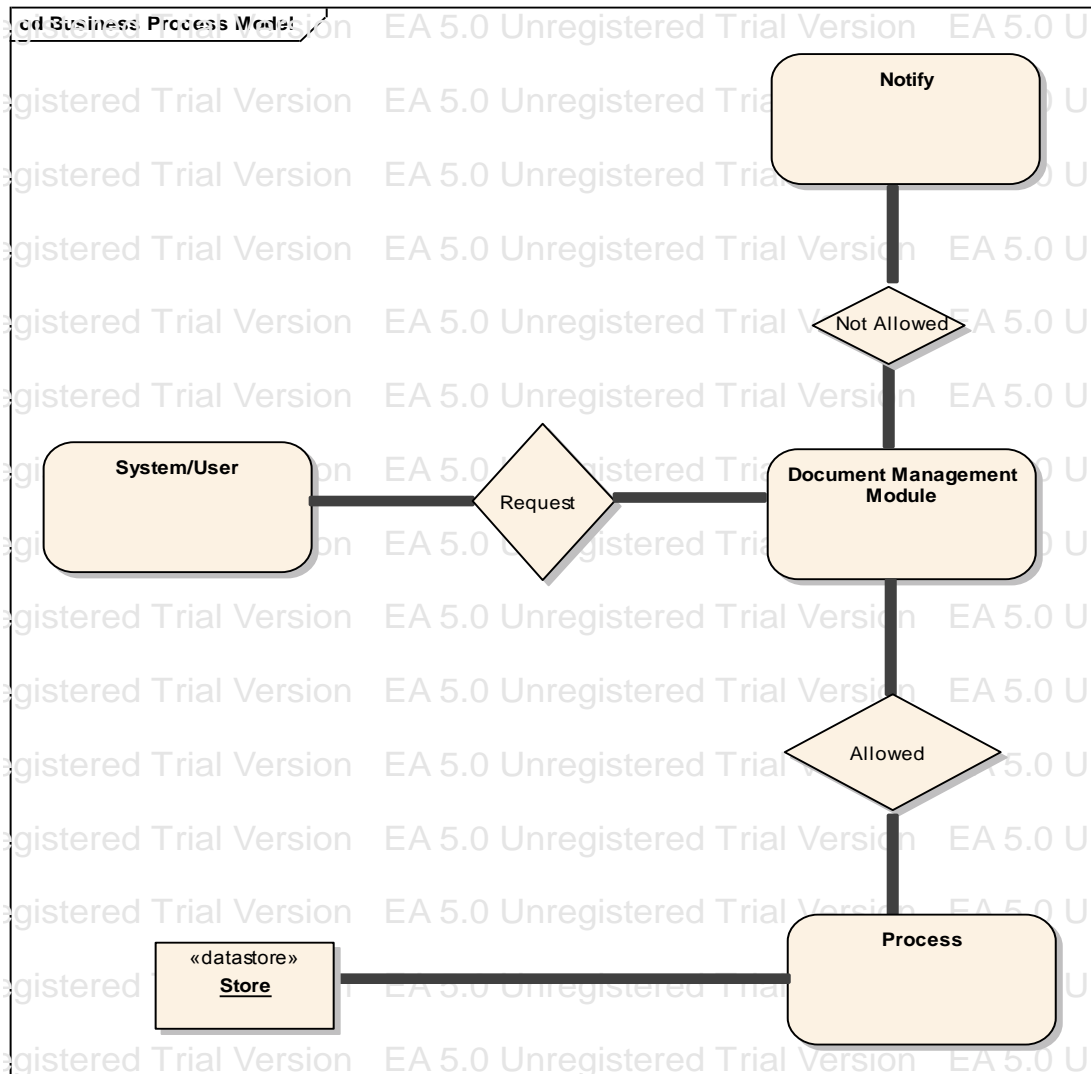


Figure 32: Document Management workflow

6.3.1 Document Management Main Screen

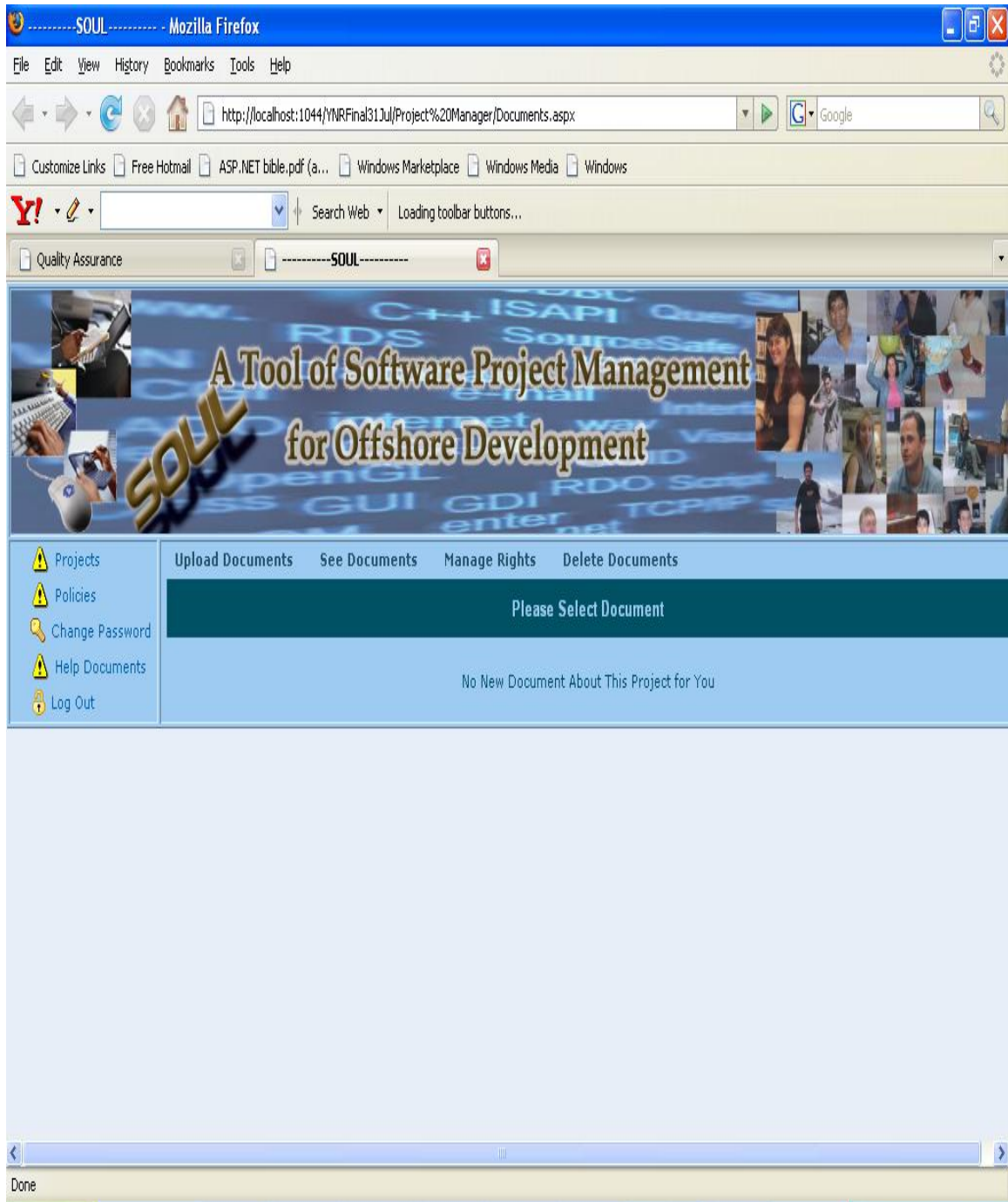


Figure 33: DMM Main screen

6.3.2 Upload Document Screen

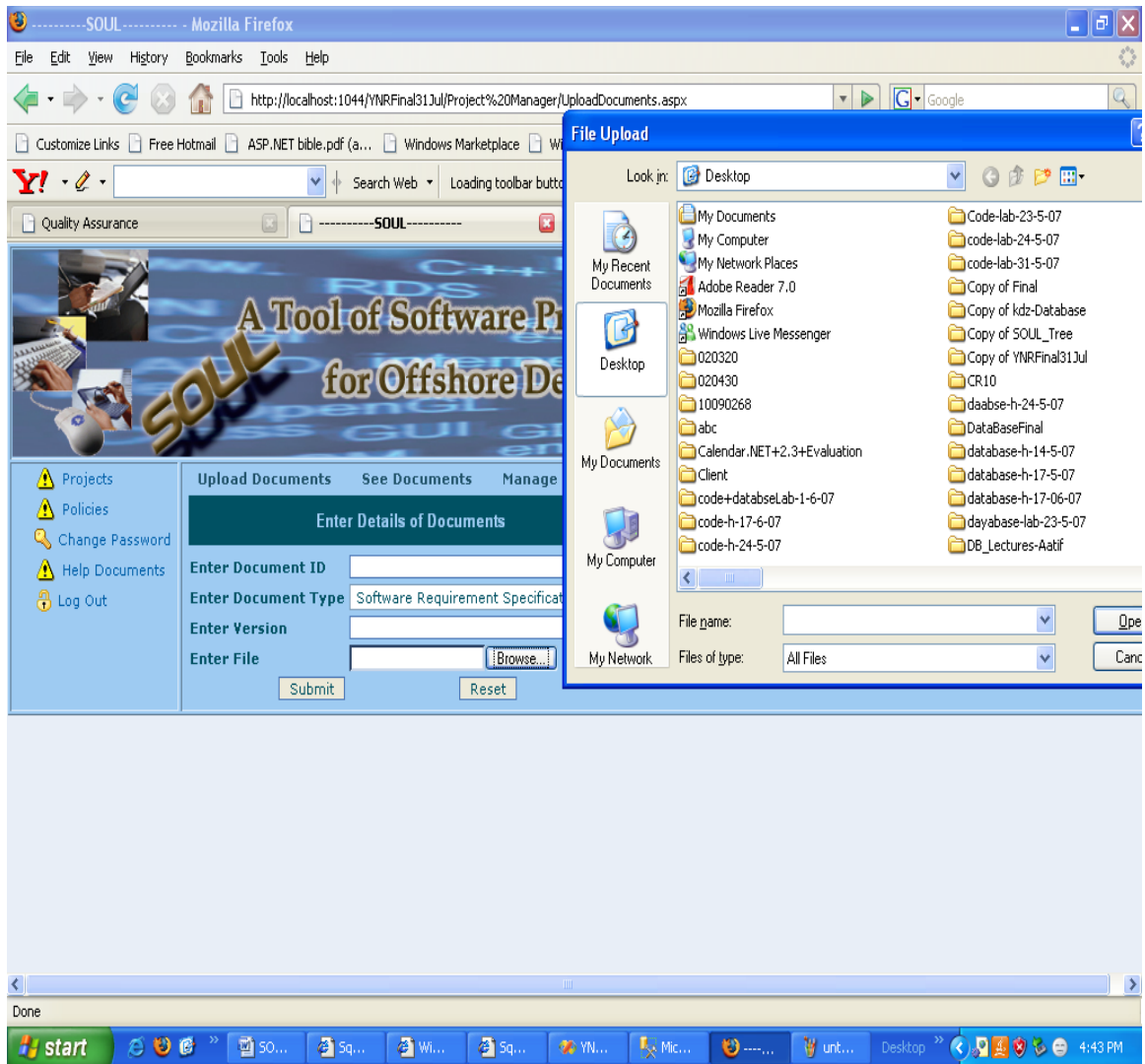


Figure 34: Upload Document screen

6.4. Policy Management

Policy management module is designed in a way to control the actions of user.

Any user with roles of Administrator could access this module to create/update/edit/delete user record and assign them different privileges to access, projects, data, tasks, documents, etc.

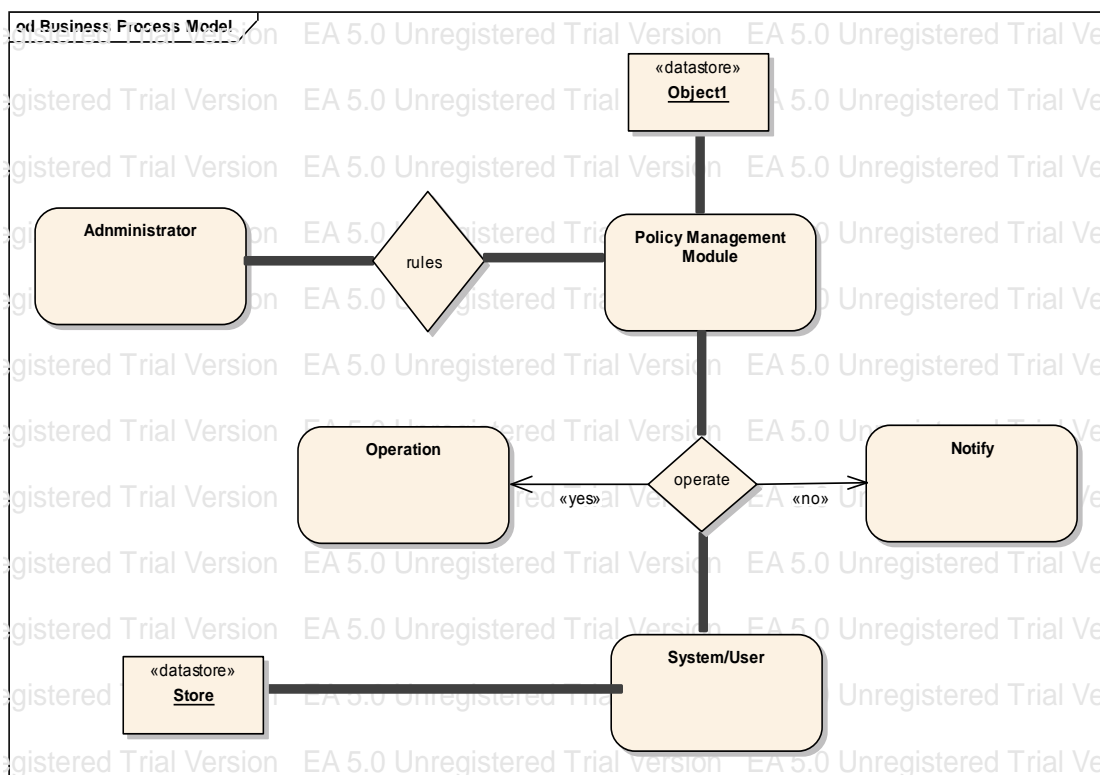


Figure 35: Policy Management workflow

6.4.1 Main Admin Screen

The screenshot shows a Mozilla Firefox browser window titled 'Administrator - Mozilla Firefox'. The address bar displays 'http://localhost:1044/YNRFinal31Jul/Administrator/'. The page content includes a sidebar on the left with the following links: Create User, Create Customer, Message Board, Calendar, and Sign Out. The main content area is titled 'Existing Internal Users:' and contains a table with the following data:

Employee Name	Sex	Email	Phone	Mobile Number	Designation	Department	Status
Edit User Asma	Male	asm@asm.com	051-4411316	0333-2255467	TeamLead		
Edit User Ali	Male	aa@aa.com	4411111	0300-3333333	Team Lead		
Edit User Amna	Female						
Edit User Yasir mehmoood	Male	43yasirm@niit.edu.pk	051-5792794	0300-9794990	Project Manager		
Edit User Abdul Razzaq	Male	dsfds@gmail.com	2544554545	03006565656	Software Developer		
Edit User Aatif Kamal	Male	aatif@niit.edu.pk	051-9858855	0321-5286149	Project Manager		
Edit User dsfdsfsd	Male	asdasd@niit.edu.pk	846546646	5645645646	Software Developer		
Edit User Tufaila	Male	yasir776@yahoo.com	051-4411312	0321-5286145	Director	Engineering	Active
Edit User EMPLOYEE	Male	email@mail.net	333-7777777	0333-7777773	Designation	deptr	status
Edit User Faran	Female	faran@yahoo.com	051-2314566	0321-5555555	Developer	Engineering	Active
Edit User jdshf dsf	Male	jdshf@niit.edu.pk	545645656	545645645646	Software Developer		
Edit User EMPLOYEE	Male	email@mail.net	333-7777777	0333-7777777	Designation	deptr	status
Edit User EMPLOYEE	Male	email@mail.net	333-7777777	0333-7777777	Designation	deptr	status
Edit User kjdsfkjh	Male	dasdd@niit.edu.pk	54646646	554646546	Analyst		
Edit User kjdsfkjh	Female	dasdd@niit.edu.pk	54646646	554646546	Program Manager		
Edit User Khurshid Alam	Male	sheedalam@yahoo.com	54545454	03006565655	Software Developer	Programming	Employeeed
Edit User Babloo	Male	yasir776@yahoo.com	051-5533558	0321-5286145	G	G	Active
Edit User Yasir Zahoor	Male	43yasirz@niit.edu.pk	051-5599585	0300-9740306	Program Manager		
Edit User Khurshid	Male	43khurshid@niit.edu.pk	051-5533558	0321-5467891	Manager	Services	Active
Edit User Khurshid	Female	43khurshid@niit.edu.pk	051-5533558	0321-5467891	Manager	Services	Active
Edit User Yasir Riaz	Male	43yasir@niit.edu.pk	051-4599585	0300-9745306	Business Analyst		
Edit User Omar Hameed	Male	43omarh@niit.edu.pk	54569875	030054564564	Team Lead		
Edit User Khadija Khan	Female	43khadija@niit.edu.pk	051-9855455	0333-6549872	Team Lead		
Edit User ABCDEF JHIJK	Female	abcdef@yahoo.com	999999999	0999-5847652	Software Developer		
Edit User gfCDEF JHIJK	Female	abddéf@yahoo.com	9933999999	0922-5847652	Chief Technical Officer		

Figure 36: Main Page

6.4.2 Permissions Screen

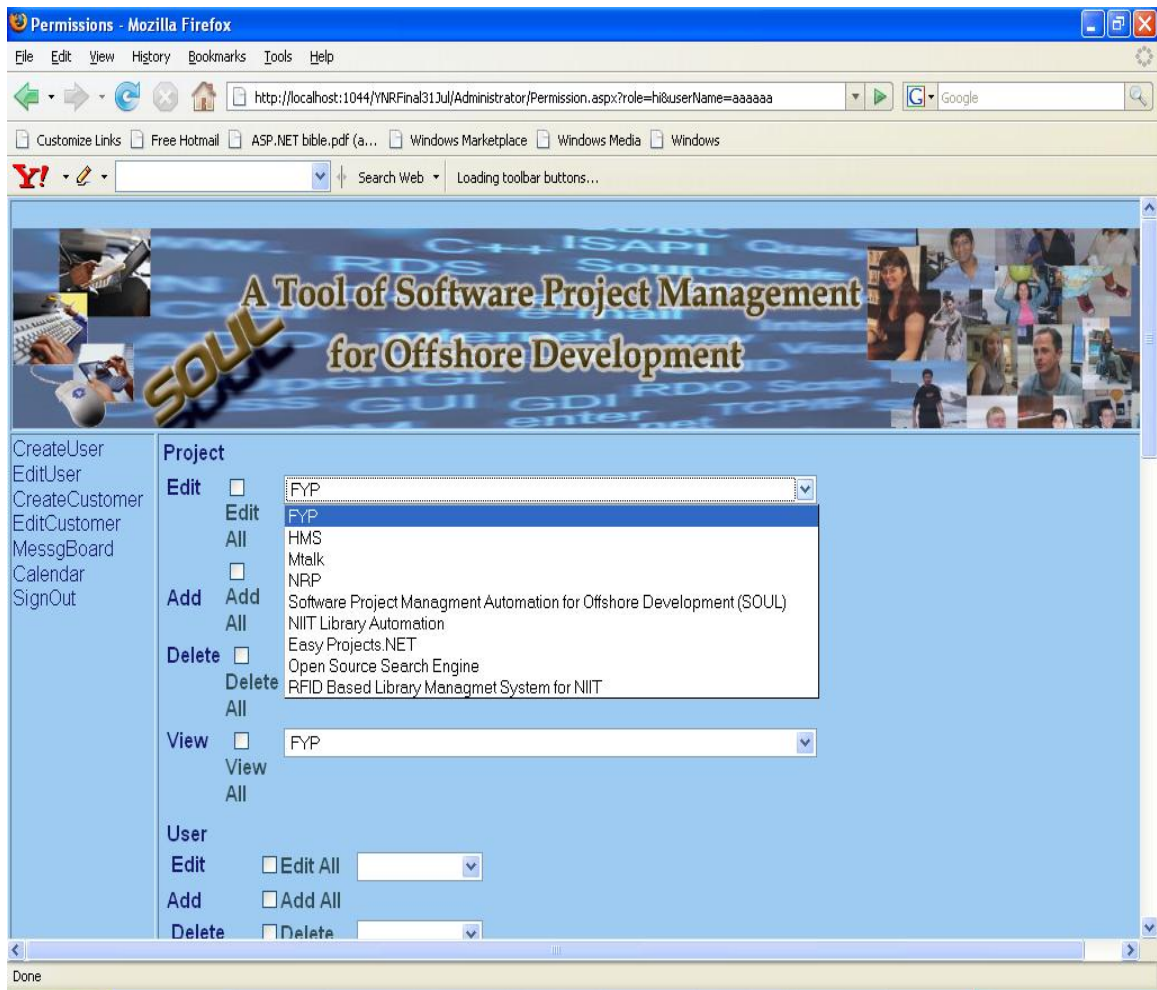


Figure 37: Permission screen

Chapter 7

7. USER MANUAL

7.1. Overview

This chapter provides the step-by-step guide to use some of the modules of SOUL discussed in this report. This will help the user to understand the system easily and quickly.

7.2. Login

The user will be prompt to enter login information along with role. The system will authorize the user and on verification, the main page would be open for a particular user depending on his role.

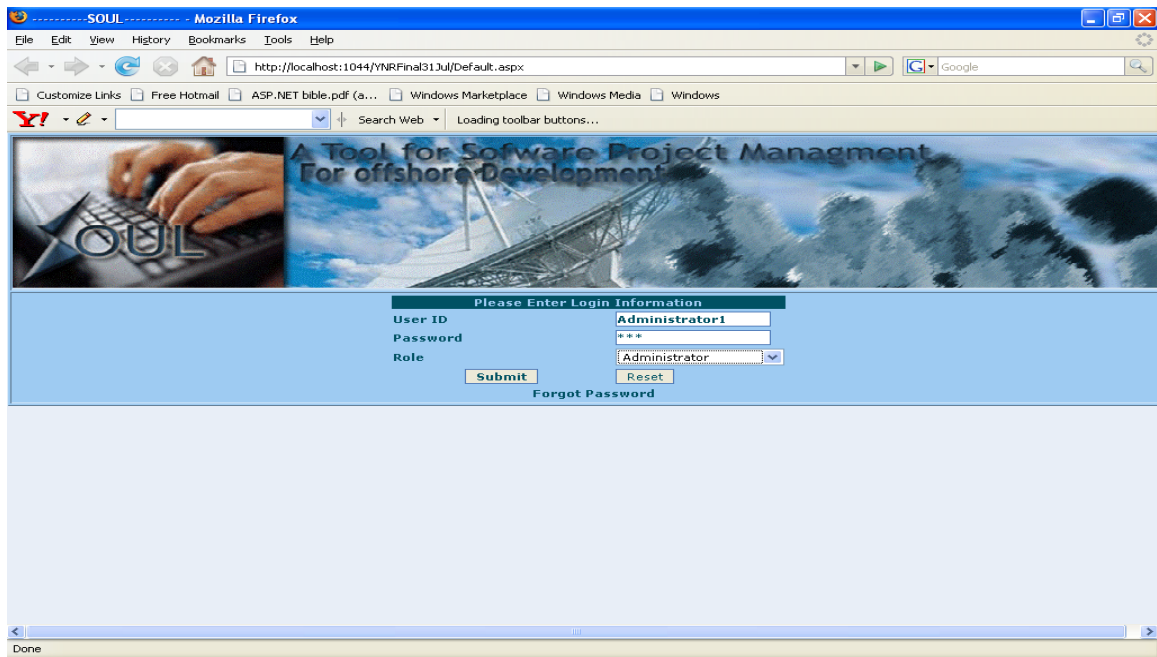


Figure 35: Login screen

7.3. Policy Module

Only User with Administrator rights may access this module. The user may be able to create user/edit user/ delete user and set their permissions based on groups.

7.3.1 Create User Screen

SOUL

A Tool of Software Project Management
for Offshore Development

[Create User](#)
[Create Customer](#)
[Message Board](#)
[Calendar](#)
[Sign Out](#)

Employee ID

Name

Gender

Birth Date(*)

Email

Designation

Department

SSN

Phone

Mobile

Address(*)

Qualification

Expertise

Socialization

Figure 39: Create User screen

Similarly user may select click on any other link.

If the user is assigned one of the default groups, default permissions specific to that group would be assigned to the user else new permissions will be assigned by entering new values on permissions page.

7.3.2 Permissions Screen

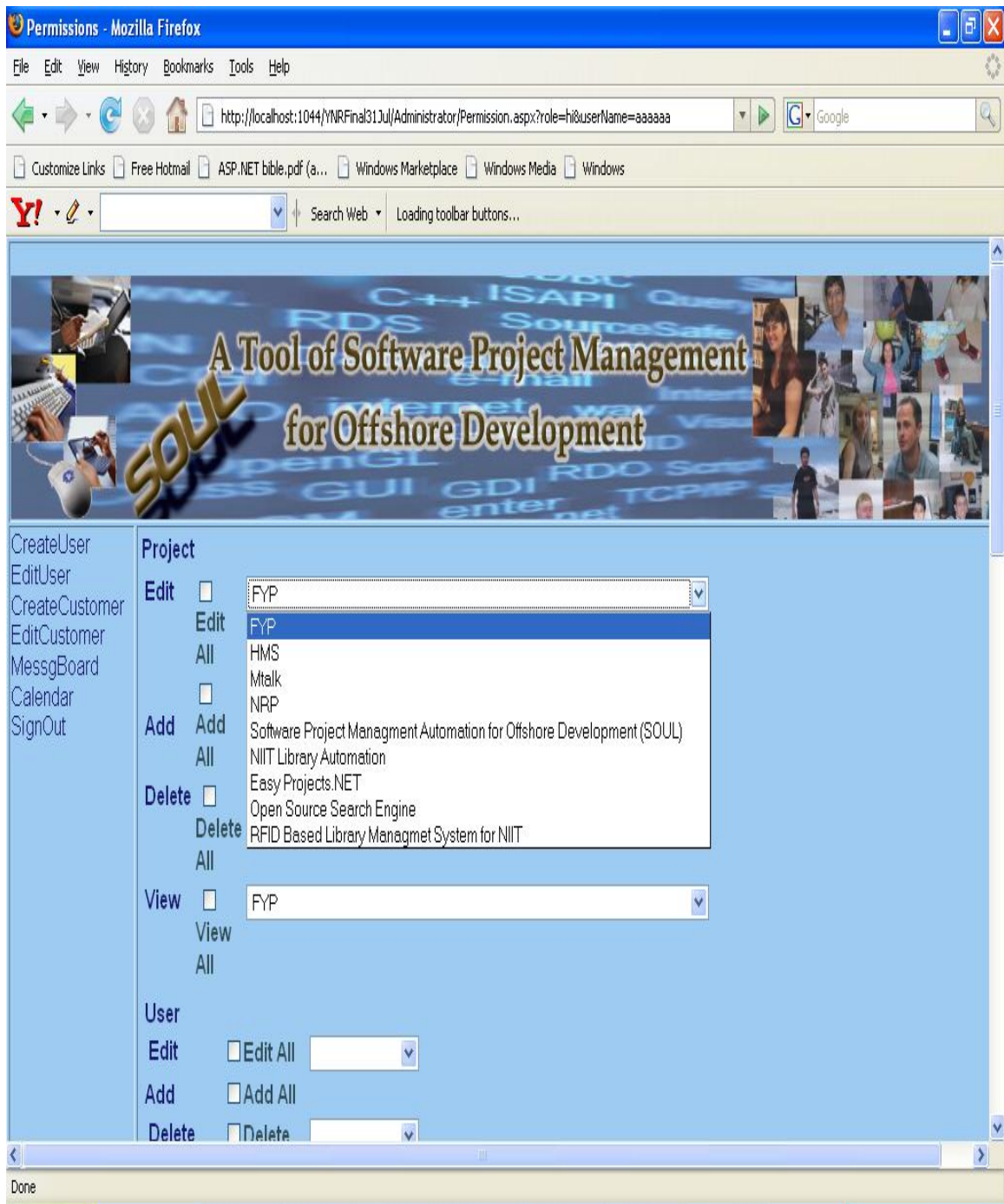


Figure 40: Permission screen

7.4. HR Module

HR user may search resource (Human or Equipment). Receiving request from user performs automatic search. Required resources are allocated to the request sender and appropriate changes are made in the database. Otherwise, notification is send to the request sender.

7.4.1 Human Resource Request Screen

The screenshot shows a web application interface for HR requests. The browser window is titled 'Administrator - Mozilla Firefox' and the address bar shows 'http://localhost:1044/YNRFinal313Jul/HR/'. The page has a blue header with the text 'SOLUTION for Offshore Development'. On the left side, there is a navigation menu with links: Resource Requests, Message Board, Calendar, and SignOut. The main content area is divided into two sections: 'Human Resources Request:' and 'Equipment Resource Request:'. The 'Human Resources Request:' section contains a table with the following data:

Request ID	Resource Type	Required Date	Duration	Education	Experience	Expertise	Quantity	Project
12	Human	1/1/2007 12:00:00 AM			1	Java, SQL	5	
13	Human	6/21/2005 12:00:00 AM			2	Java	1	
14	Human	5/7/2007 12:00:00 AM			2	Java	5	
15	Human	2/12/2004 12:00:00 AM		BS(SE)	5	Java	2	
18	Human	7/20/2008 12:00:00 AM			5	Java	2	
19	Human	7/20/2007 12:00:00 AM			5	Java	2	
20	Human	7/10/2007 12:00:00 AM			5	Java	2	

The 'Equipment Resource Request:' section contains a table with the following data:

Request ID	Quantity	Project	Resource Type	Required Date	Duration	Company	Equipment
17	5		Equipment	2/12/2004 12:00:00 AM		Intel	Processor

Figure 41: HR Request screen

7.5. Estimation Module

Estimation Module implements COCOMO Model to provide project estimates.

Program Manager sends the request. Estimation is performed and the request sender is notified of the results.

7.5.1 Estimation Screen

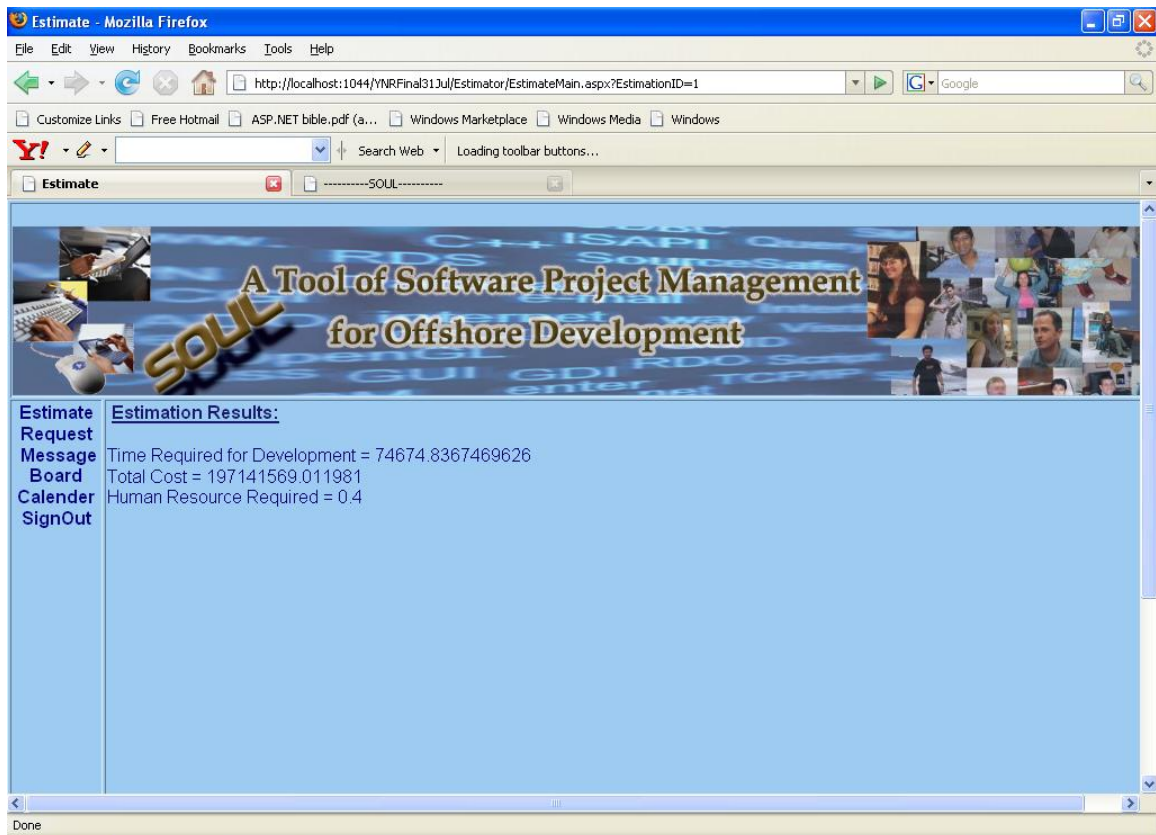


Figure 42: Estimation screen

7.6. QA Module

QA module is responsible to track the progress of the project, user performance and to ensure the quality of the project. User may create daily tasks by clicking Task sheet and entering daily activity against date. User may also create/edit/delete Bug against particular project. A bug report is generated which shows the performance of an individual user. Similarly, a progress report is generated based on Task Sheet. All the functions are right based as defined in Policy Module.

7.6.1 Create Bug Screen

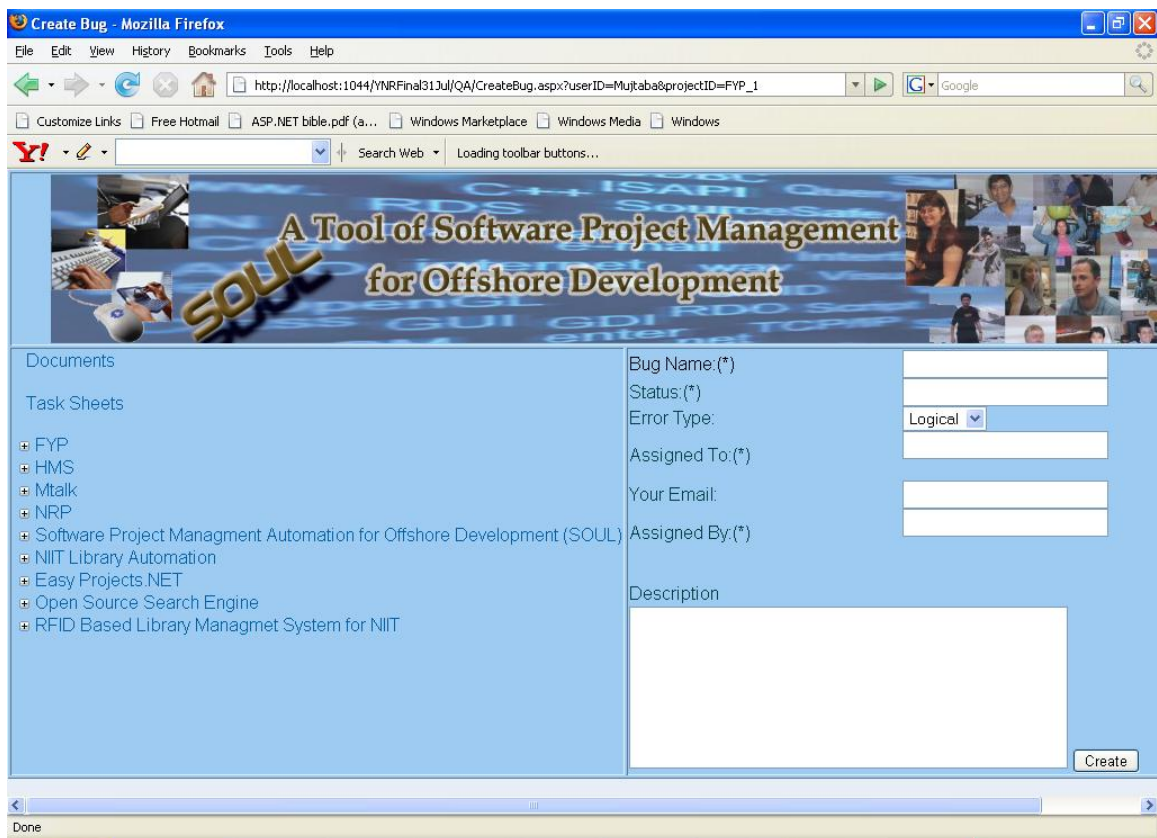


Figure 43: Create Bug screen

7.6.2 View Bug Screen

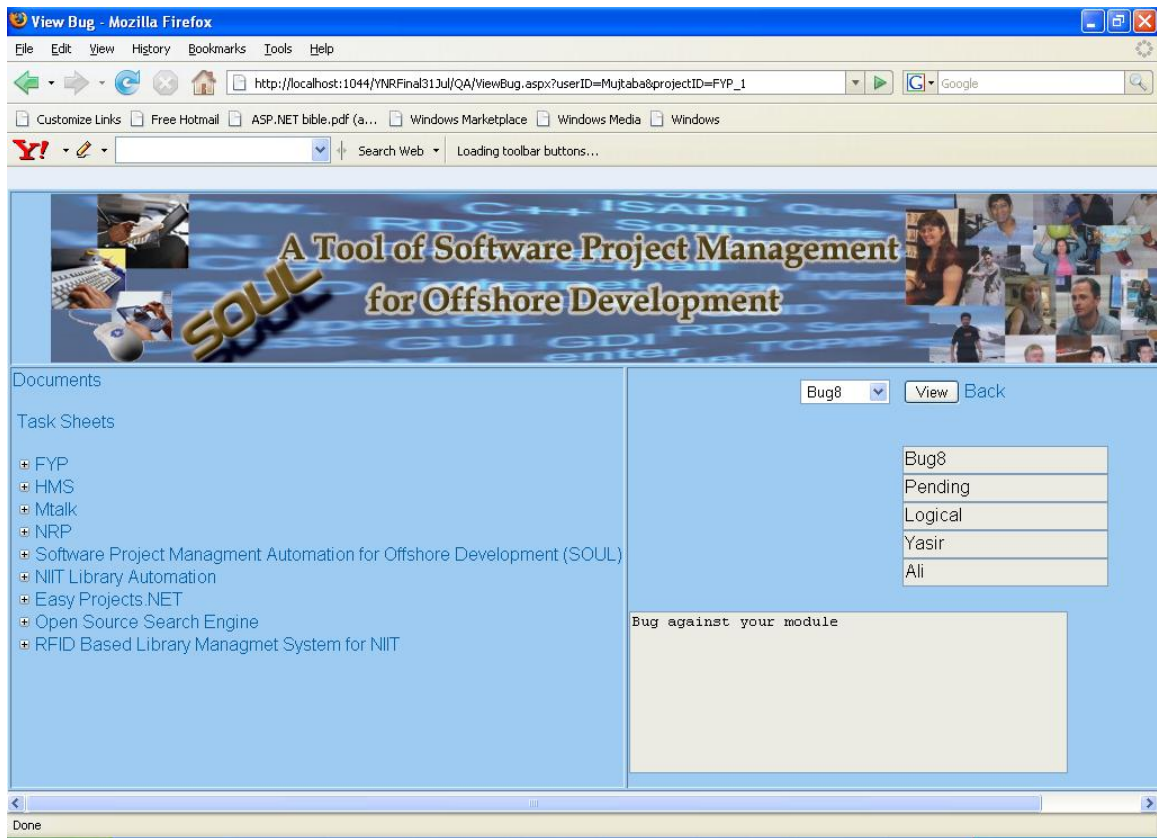


Figure 44: View Bug screen

7.6.3 Delete Bug Screen

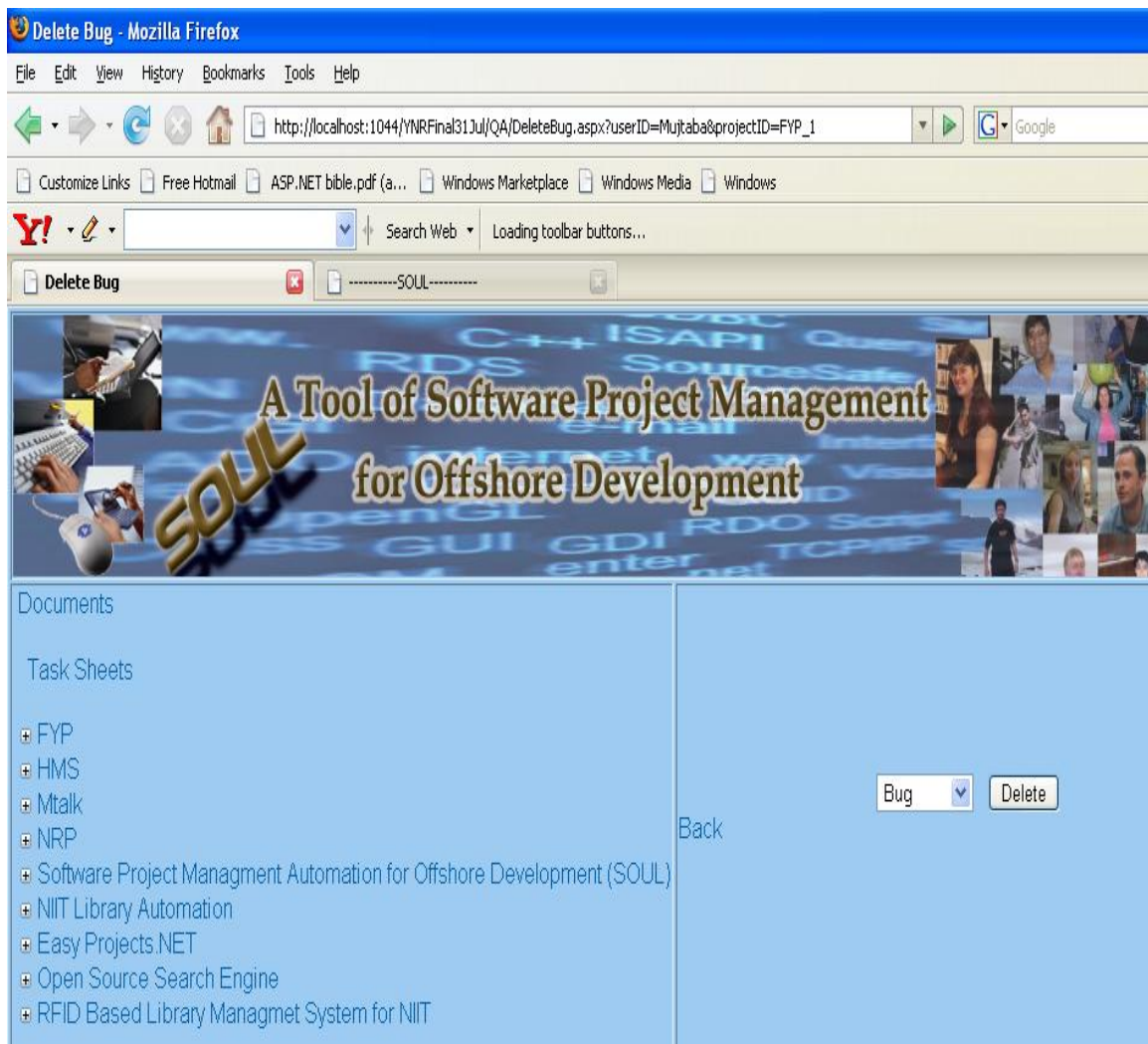


Figure 45: Delete Bug screen

7.6.4 Create Task Screen

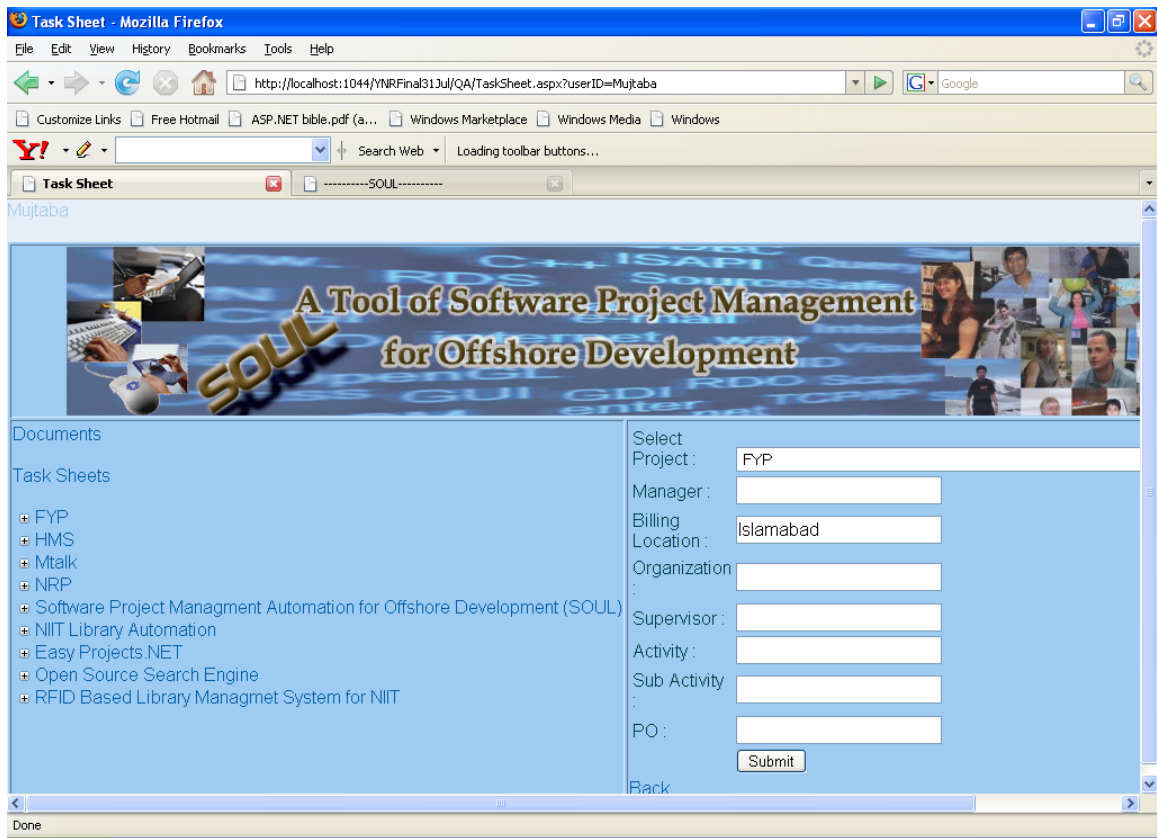


Figure 46: Create Task screen

7.6.5 View Task sheet Screen

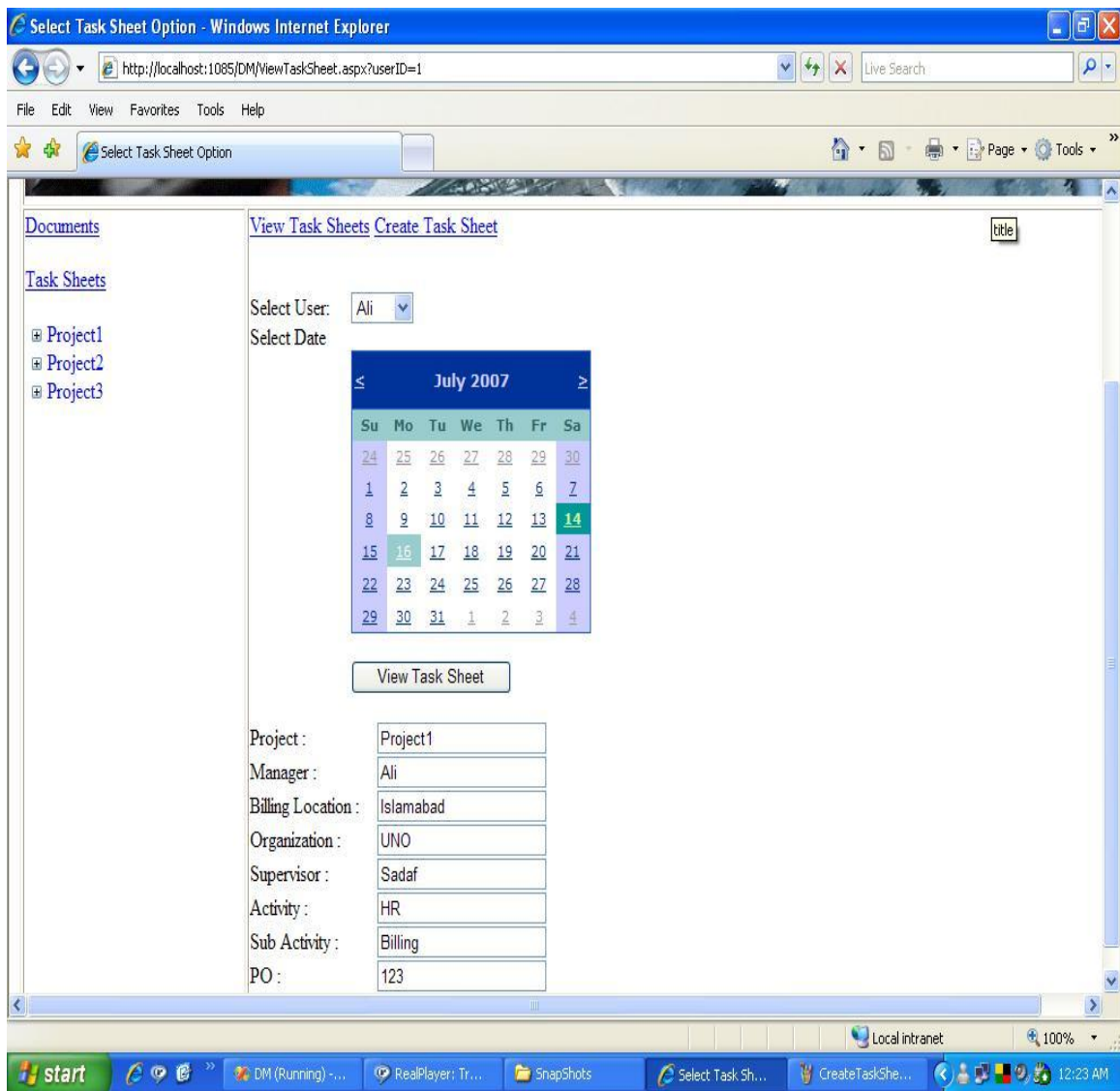


Figure 47: View Task sheet screen

7.7. Document Management Module

User may create/edit/download/rename the documents based on rights as defined by Administrator. In case of document, the documents would be maintained under folders of respective projects and autonomous versioning would be supported to avoid more than one document with same name. In case of template, there is no versioning and templates would be maintained on server without any complex directory structure.

7.7.1 Delete Document Screen

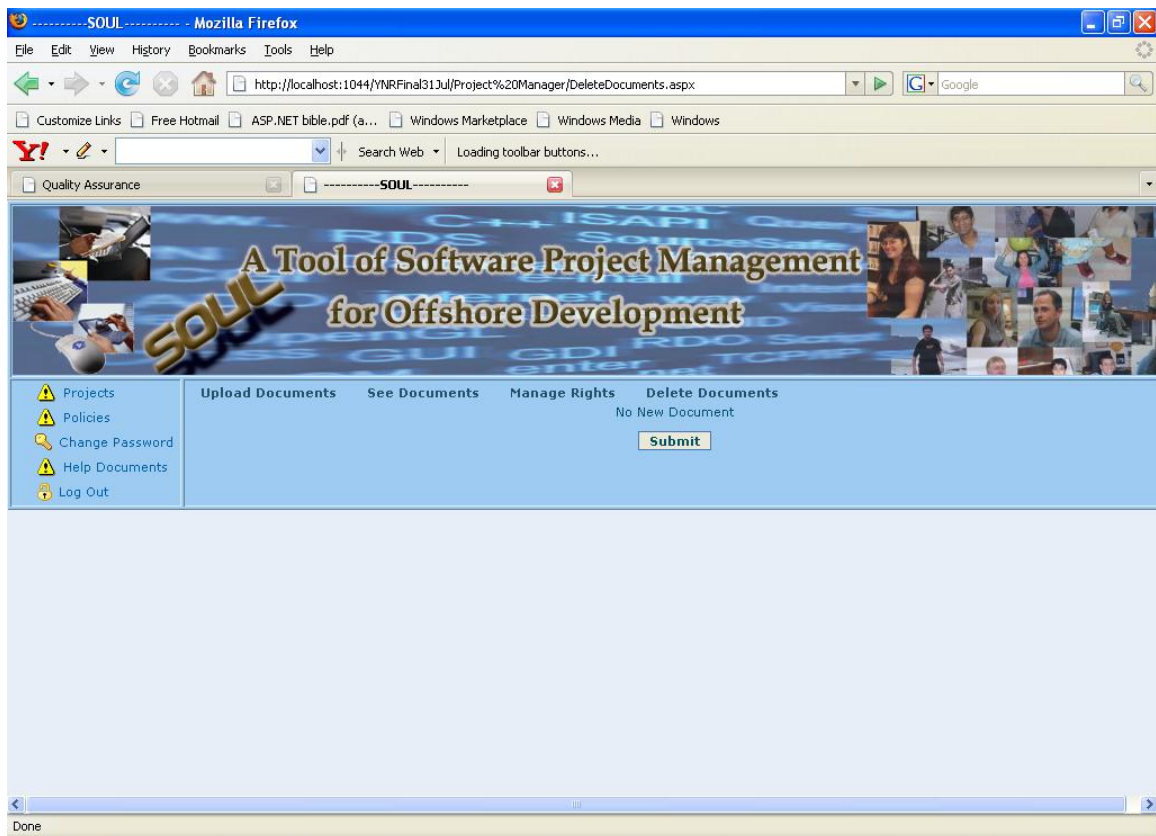


Figure 48 Delete Document screen

Chapter 8

8. CONCLUSION AND FUTURE WORK

8.1 Successful Completion

By the grace of Allah – Almighty the task of developing a generic automated solution for software house has been completed in allocated time. SOUL works according to the workflow and requirements set by Project Management standards.

8.2 Learning Gained

During the process of developing SOUL there had been a chance to go through each and every process of Software Development Life Cycle (SDLC) and Project Management Institute standards. So a chance to practically experience our concepts was fully available.

8.3 Difficulties

- Developing a generic solution that works for every software house without big pain
- It was quiet difficult for me to manage time along with job and course studies, but by grace of Almighty ALLAH, prayers of my family and

efforts of Mr. Mujtaba, I have been able to complete this project successfully

- I faced lot of difficulty while designing Crystal Reports for generic data sets.

8.5 Future Directions

- I am looking forward to further work on this project to make it a complete and commercial Software House automation solution
- I intend to devise a new estimation algorithm to increase efficiency and accuracy of estimates.

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