SUDAN UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF COMPUTER SCIENCE AND INFORMATION TECHNOLOGY

WEB APPLICATIONS GENERATOR FRAMEWORK

OCTOBER 2016

THESIS SUMITTED AS A PARTIAL REQUIREMENTS 0F B.Sc. (HONOR) DEGREE IN SOFTWARE ENGINEERING

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بسم الله الرحمن الرحيم

SUDAN UNIVERSITY OF SCIENCE AND TECHNOLOGY
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…………………………….......   **…. OCTOBER 2016**

الآية

قال تبارك و تعالى:

قَالَ رَبِّ اشْرَحْ لِي صَدْرِي وَيَسِّرْ لِي أَمْرِي وَاحْلُلْ عُقْدَةً مِنْ لِسَانِي *يَفْقَهُوا قَوْلِي"

الحمد لله

اللهم لك الحمد الذي أنت أهله هُعلنا نعمما كنت قطلها أهلا متأزددتُ تقصير اً تزدني تفضلاً كأني بالتقصير أستوجبالفضلا

****

اللهم إن نعمك كثيرة علينا الا نحصيها و لانحصي ثناء عليك و لانقدر و أنت سبحانك كما أثنيت علنن فسك و أنت سبحانك غني عنا لعالمين

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شكر و عرفان

الإهداء

إلى من ربي الجنة تحت قدميها ومن اقترن اسمي به ...أهديكم جُل عملي وأنا الطالب لرضائكم دوما

(أُمي .. أبي)

إلى تلك المنارة التي لطالما اضاءت ظلمة الجهل فيني ... بنورها خطوت خطواتي فكان بريق نجاحي

(جامعتي)

إلى تلك الشموع الواقفة دوماً تجئ إلينا بنور وضوء ..تفك الطلاسم و تحكي طريق النجاح مداداً و رؤى

(أساتذتي)

إلى من لم تلدهم امي ..و لكن أشقاء عشنا سوياً نهلا معاً بكينا فرحنا فكنا إخوة بهم أفتخر

(أصدقائي)

منك تعلمنا أن للنجاح قيمة و معنى .. و منك تعلمنا كيف يكون التفاني و الإخلاص في العمل و معك آمنا ان لا مستحيل في سبيل العلم و المعرفة فلك منا أسمى آيات الشكر و التقدير و تأتي المفردات منساقة لمن كان قوساً جيَد التصويب في إيلاج المعرفة و طرق البحث لعقولنا و لطالما كنت العون الصادق في سبيل ما نصبو إليه سنظل نحترم فيك توجيهنا الصادق لتمتد ايدينا لنيل درجة بكالوريوس هندسة البرمجيات

(أ. محمد نافع)

ABSTRACT

Because of the continuous increase in the requirements of Internet's users,Web applications become more complex which make the traditional way to create such applications -writeapplication's code-from scratch by the developers' impractical way.

The aim of the study is to help the developers of Web applications by reducing the time and efforts in the creation of such applications by restricting all patterns that are common in most web pages (such as insertion, deletion, and other patterns) in a set of libraries that make up the framework in turn.

To study the problem and test the proposed solution has been to apply the following steps: Creating aweb application without the use of the web applications framework for a simple student registration system and thenre-create the same application using the web applicationsframework designed in this study.

The study found a number of conclusions and they are:the useof web applications framework in the creation of web applications reduces the effort and time expended by the developermarkedly, increase the developer's confidence in the developed application and creation of the web applications with identical pages to international standards for creation of web pages.

The web application framework that developed I this research help developers, but still developer need to write codes to specify the web page's components, so researchers recommend others who will complete the research to find a way in which developer need not to write code such as drag and drop.

المستخلص

بسبب الإزدياد المستمر في متطلبات مستخدمي الانترنت، أصبحت تطبيقات الويب تتسم بدرجة كبيرة من التعقيد مما جعل الطريقة التقليدية لإنشاء مثل هذه التطبيقات و هي كتابة شفرة التطبيق من الصفر بواسطة المطور طريقة غير عملية.

الهدف من الدراسة هو مساعده مطوري تطبيقات الانترنت بتقليل الزمن و الجهد المبذول في إنشاء مثل هذه التطبيقات و ذلك عن طريق حصر كل الأنماط المشتركه في معظم صفحات الانترنت مثل (الإدخال، الحذف و غيرها من الأنماط) في مجموعة من المكتبات التي تشكل بدورها إطار العمل.

لدراسة المشكلة و إختبار الحل المقترح تم تطبيق الخطوات التاليه: إنشاء تطبيق انترنت بدون استخدام إطار العمل لنظام تسجيل طلاب بسيط و إعادة إنشاء نفس التطبيق باستخدام إطار العمل الذي تم تصميمه في هذه الدراسة.

توصلت الدراسة إلى عدد من النتائج و هي: استخدام إطار العمل في إنشاء تطبيقات الانترنت يؤدي إلى تقليل الجهد و الزمن المبذول من قبل المطور بصوره ملحوظة، زيادة ثقه المطور في التطبيق المنشأ و إنشاء تطبيق انترنت ذو صفحات مطابقة للمواصفات العالمية لإنشاء صفحات الويب.

اطار العمل الذي تم انشاؤه في هذا البحثيساعد المطورين بصوره كبيره و لكن ما زال علي المطور ان يكتب بعض الشفرات لتحديد مكونات صفحه الويب و بالتالي يوصي الباحثون الاشخاص الذين سيكملون البحث بإجاد

الوسيلهالتيتجعلالمطورلايحتاجلكتابهشفرههمثلالسحبوالادراج.

Glossary

#	Term	Description
1	WWW	World Wide Web
2	WAF	Web Application Framework
3	WF	Web Framework
4	CGI	Common Gateway Interface
5	MVC	Model View Controller architecture
6	JNDI	Java NamingDirectory Interface
7	PYPL index	Index calculated by analyzing how often language tutorials are searched on Google
8	W3Techs	World wide web technology survey
9	JSON	JavaScript Object Notation
10	HTML5	Hyper Text Markup Language version 5
11	CSS	Cascade Style Sheet
12	iText 5	Java library to display, modify and create PDF files
13	Apache POI	Apache Poor Obfuscation Implementation

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CHAPTER ONE

Introduction

1.1 Introduction

Web applications have become an important element in people's life, they use them in various aspects of their life; as a result their demands are growing continuously for more diversityapplications.Consequently, the load on the Web developers to meet all these demands continues to grow, and to help this category excellent ideas must be found. This is what the researchers are seeking to achieve in this research.

1.2 Problem Statement

found that, when a Web developer wants to create a new Web application often he repeats parts of the applications has already created previously; thus exert time and effort in the process of repetition, rather than exploit of this time and effort in developing other functionalities or improving them.

1.3 Research Objective

The primary objective, is to develop web applications framework in order to help the web developers to develop dynamic web pages without need to write huge html, JavaScript or JSP codes.

The secondary objective, is to make the developed framework represent suitable ground to apply the international standers of web pages creation.

1.4 Importance of Research

Develop framework that help developers in terms of:
- ➢ Develop faster, framework help developers to save their time by re-using generic modules and focus on other areas .
- ➢ Increase developer's income, developer can exploit the time available for one project to perform two or more projects and get double or more cost in shorter time.

> ➢ Increase developer's confidence, developer already reuse
> components that have been tested carefully and works well with
> other applications.

1.5 Research Scope

The first and foremost, the scope of this research is limited only to web applications and the targeted audiences are web developers.

This research aims to help the developers by storing number of web page's components in set of libraries.

1.6 Research Methodology

Requirements are collected by dealing with many Web applications, observed that there are many patterns common among them and these patterns are taken as requirements for the new developed framework.

In term of requirements analysis after the requirements collection process, the framework's requirements collected (by observation of developed web applications) will be analyzed to identify the basic components of the web applications through which the web framework's library will be created.

To develop the web application framework researchers identify and select the framework libraries, three library will be created which they are:

> ➢ HTML library.
> ➢ SQL library.
> ➢ JavaScript library.
> ➢ JSP library.
> ➢ Manager library controls all other library.

1.7 Thesis Outline

In addition to this chapter this research contains another five chapters:

- ➢ Chapter two include thetheoretical framework about web application, its frameworks and contain the related studies.
- ➢ Chapter three contains the tools and techniques that used in this research.
- ➢ Chapter four contains describe how the framework analyzed and designed.
- ➢ Chapter five, contains the steps and stages of the implementation of the system.
- ➢ Chapter six, contains results, recommendations.

CHAPTER TWO

Literature Review

2.1 Introduction

At present, provide ideal Web applications before the competitors is a challenge, write a complete code from scratch and repeat functions that have been made in advance it can be a time-consuming process and make developers get bored; it is possible to invest this time to add new functions and/or perform further tests to cover all the gaps cationic or influencing the web application.

This chapter includes details about the Web Applications Frameworks and also five related studies about developed Web Applications Frameworks.

2.2 Theoretical Framework

2.2.1 Web Applications

The World Wide Web (WWW) was created in 1990, the begging of the Web or (World Wide Web) was very static, and it was hard to the users to interact perfectly with the content at the same way users interact nowadays. There was always need to create the content locally and then upload it to servers and this was the reason to create Common Gateway Interface (CGI) for interfacing external applications with web servers. [1]

The period of 1995-1996 was the golden period of the growth in web pages' development and e-commerce start to flourish.

A web application is a distributed application that runs on more than one computer and communicates through a network or a server. Specifically, a web application is accessed with a web browser as a client and provides the ability to update and maintain a program without deploying and installing software on client computers. [2]

Web browsers used by web applications such as Google chrome, Mozilla Firefox, Apple Safari, Netscape Navigator, Microsoft Internet Explorer.

Web applications are better than desktop applications for these reasons:

➢ Web applications only need to be installed in web server but desktop applications need to be installed in every computer need to access them.
➢ Not need to pass on all computers to maintain the applications so maintainability of web applications is easier than desktop applications.
➢ Client computer need a web browser only.
➢ Web applications can be accessed from anywhere.
➢ Web applications are cross platform.
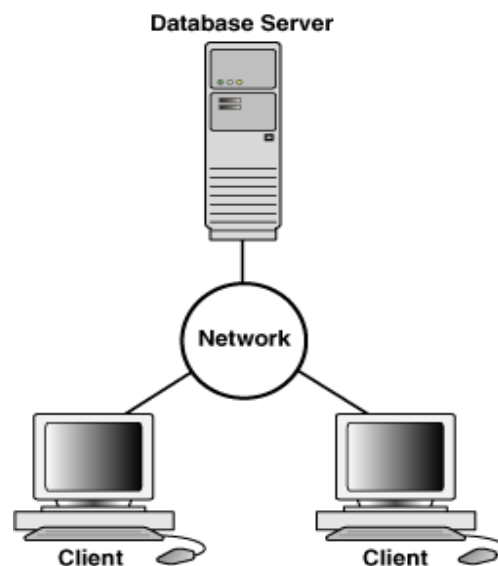
Figure 2.1 web applications architecture [3]

2.2.2 Web Applications Frameworks

We can say that, Frameworks are the skeleton or the base to build something, however there are many types of frameworks available in the context of software development.

Web application frameworks(WAF) or simply Web Frameworks (WF) briefly, set of prewritten libraries of code that most web applications benefit from services and functions provided by them. [1]

2.2.3 Types of Web Frameworks

Three types of web application frameworks based on activeness degree and they are: [1]

> Passive frameworks**:** are collection of files, developer need to unpack and use them to create his/her project from them. This type of Web Application Frameworks requires extra configurations.
> Semi-active frameworks: in this type of frameworks the web application's code generated from another code which contains developer's commands.
> Active frameworks: are frameworks that do which semi-active frameworks do but they are working in the background by writing/creating/generating code automatically without any command from the developer.

The type of Web Applications Framework developed in this research is "Semi-active" framework.

2.2.4 Advantages of Web Frameworks

Frameworks, represent a distinctive mark in the developer's life for several reasons some of them: [1]

> While developer reuse code already tested, the reliability of the developer will be increased.
> While developer not need to re-write a code again the development time will be reduced.

➢ Reducing development time which is consequent of reusing code increase developer income because it became easy to work more than one project at one project time.

➢ Get help from others (actual framework's developers), if web developers start from scratch they need to think about every think – for example, form validation - but when using the Web Application Frameworks, web developers not need to waste their time in thinking about issues the developers of the frameworks already prepared.

➢ By upgrade other's framework, developer can get more features without more implementations.

➢ Frameworks can be used as learning tool for the beginners.

However, there are more advantages of using Web applications frameworks.

2.2.5 Disadvantages of Web Framework

Web application frameworks have positive side and negative side as everything in life some of those disadvantages of Web applications framework are: [1]

➢ May need time to learn how to use web frameworks.
➢ Developers learn the frameworks not the underlying languages.
➢ If bugs found in the frameworks this will reflected to the generated applications.
➢ Some frameworks don't provide enough flexibility to the developers.
➢ The developer's feeling that he/she is productive when develop from scratch will be less. But note that this just feeling not fact, even if developer use frameworks or not while he/she perform his/her task on time this is the mean of productivity.

However, there may be other disadvantages of the Web Application Frameworks from the points of views of web developers use them.

2.2.6 Who Use Web Framework

Web application frameworks can be used by many individuals some of them are: [1]

> ➢ Beginners outside the fields of computer science, who know some programing but they don't know web page development practices and techniques.
> ➢ Developer who have tasks must be done in limited time.
> ➢ Amateurs who developing web applications as a hoppy and they don't study computer science or one of its branches.

2.2.7 Who Shouldn't Use Frameworks

Sometimes it is better to not use Web Application Frameworks by some individuals such as:

> ➢ Students, because they must learn language not a framework.
> ➢ Experienced developers, who want to do complex functions not provided by frameworks although this research's framework provide good degree of flexibility in term of override code's functions.

2.2.8 MVC (Model View Controller) Architecture

Most web applications frameworks based on MVC Architecture (Model-View-Controller Architecture) as framework on this research,MVC is a

pattern mainly used for developing web applications, because it helps the developer to have a clear understanding of all the modules. MVC separates the business layer (Model logic), the display layer (View logic), and the control layer (Controller logic). [4]

Model: is an abstraction layer, which presents data in an application.

View: is the layer that present data in suitable and in desire format for end client, and usually presented as a HTML web page.

Controller: is the layer that handles requests and return appropriate responses to the correct View.
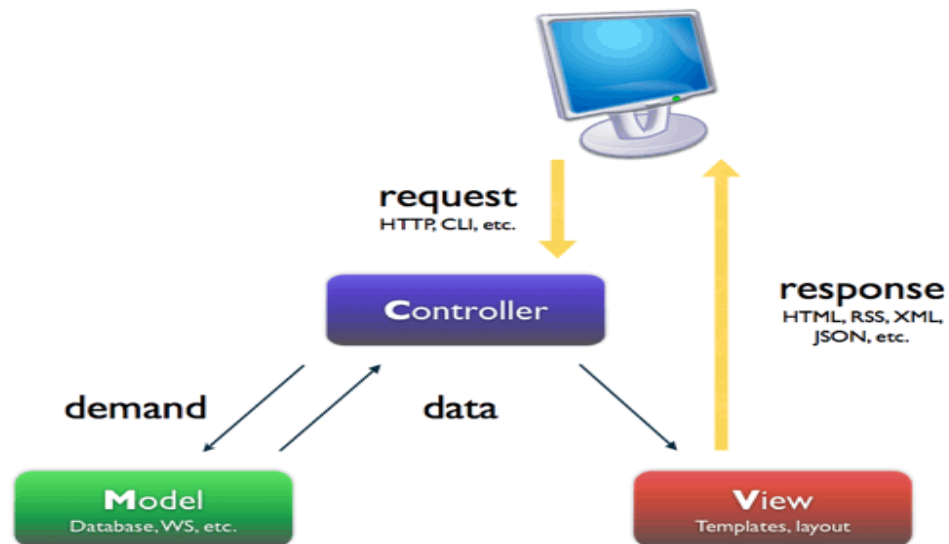

Figure 2.2 MVC Architecture [5].

2.3 Related Studies

As web application framework on this research use to develop dynamic web page the following related studies are used to the same purpose.

2.3.1 ASP .NET Framework

ASP.NET is a new web development model and the successor of Aspect Server Pages (ASP) technology. ASP.NET enables developers to build a wide variety of secure server-side and browser-based applications such as e-commerce, dynamic websites, and e-learning applications. [6]

Some advantages of ASP.NET framework:

➢ It is an open source web framework.

➢ Dramatically decreases amount of code necessary to build rich applications.

➢ Provide free hosting for developer's websites.

Some ASP.NET framework's disadvantages are:

➢ Limited the developers if they want to perform their own JavaScript solutions or advanced designs; researchers try to resolve this defect by allow the developers to override this research's framework components.

➢ Provides web visitors with slower response and increasing bandwidth demand on sever; this is what researchers have to treat it by using Java Naming and Directory Interface (JNDI) connections.

➢ ASP.NET framework limited to windows operating system only; this is what researchers try to resolve by develop framework works in many operating systems.

2.3.2 Laravel5 Framework

Laravel5 is a Web Applications Framework that tries to ease the development process by simplifying repetitive tasks used in most of today's web applications, including but not limited to caching and sessions.

According to recent statistics from W3TechsLaravel5 is one of the most successful PHP framework in 2016, based on annual framework popularity survey. [7]

Some of laravel5 framework's advantages:

➢ Open source framework.
➢ Many web application frameworks available on internet, require huge xml configuration before starting the actual project, but laravel5 need few PHP lines of code to start the project this make it one of the best Web Applications Frameworks.

Some of Laravel5 framework's disadvantages are:

➢ When laravel5 developer need to retrieve data from database to display it on html table, developer need to write many lines of code to specify table header; this is what researchers have to treat in this research, by access database table metadata -such as column names- if developer need to change those headers he can override them by writing the new names for them.
➢ When the developer need to create data forms in laravel5 framework, developer must write the html code to create this forms in external PHP page, then include it to the main page; this is what researchers try to resolve in this research by make those forms available in html library invoked by the developer.

2.3.3 Ruby on Rails Framework

Ruby on rails it is a web applications framework written in Ruby language, it was designed to make web applications development easier by making the component that the programmers need to start available, ruby on rails framework allow developers to write less code in comparison withother Web Applications Frameworks.

Some advantages of Ruby on Rails framework:

➢ Open source framework.
➢ Because the framework written in Ruby we find that the quality of code significantly higher than their PHP equivalent.
➢ Usable.

One of Ruby on Rails Framework's disadvantage is:

➢ most developers prefer programming languages such as Java and PHP more than Ruby based on PYPL Index which calculated by analyzing how often language tutorials are searched on Google they found that 23.6% for java, 10.0% for PHP and 2.2% for Ruby and this values updated monthly, this make web developers prefer use Java web applications frameworks than ruby frameworks. This is what researchers have to treat it by developing Java framework.

2.3.4 Django Framework

Django is a python web application framework that save time and make the process of web application development a joy. Developers can make high quality and maintainable web application with minimal fuss. [8]

Some advantages of Django framework:

➢ Open source web framework.
➢ Organization, Django have pretty clear MVC layout.

> ➢ Python represent perfect programming language although it is subjective issue.

One of Django framework's disadvantages:

> ➢ Additional overhead, it is fast enough but it can be faster; this is what researchers try to resolve by develop framework without unnecessary features that decrease the framework's speed.

2.3.5 Grails Framework

Grails framework is an open source Web Applications Framework based on Groovy and Java programming languages. It was designed to combine the advantages of existing Java technologies under a simple interface. [9]

Some advantages of Grails framework:

> ➢ Open source framework.
> ➢ Dynamic configuration feature so, can change the configuration without server restart.

One of Grails framework's disadvantages is:

> ➢ Developer must learn Groovy coding; developers make use of framework to reduce time and effort and because of this defect, researchers try to use programming language most of them learned as part of their education.

Framework name	advantages	disadvantages
ASP.NET	1- Open source. 2-Dramatically decrease the amount of code used to create rich applications. 3- Free hosting.	1-Restrict the developer with the framework's JavaScript solutions and designs. 2-Slower response and increase the bandwidth demand on severs. 3-limited to windows operating system
Lravel5	1-Require few PHP lines of code for configuration before starting the actual project. 2- open source.	1-Developer need to write many lines of code to specify table's header. 2- Developer need to write many lines of code to create application's forms.
Django	1-open source. 2-programming with python.	.1- Additional overhead because of the unnecessary feature
Ruby on Rails	1-Quality of code significantly higher than PHP equivalent. 2-Open source	1. Ruby it is not popular programing language such as Java and PHP for developers.
Grails	1-open source.	1-Groovy must be learned

2- dynamic configuration.	

Table 1 : show summary of related studies.

2.4 Chapter Summery

This chapter focused on the theoretical issues of the web application frameworks and the related studies in term of others frameworks available on internet.

Next chapters will show the research methodology and tools and techniques use to develop the research's framework.

CHAPTER THREE

Research Methodology

3.1 Introduction

Providing the best solutions and simplest way to develop a web application is the aim of this research's framework. Everything in the life have advantages and also disadvantages and sure this research's framework have a lot of disadvantages that may discovered later but this framework try to solve the common problems faces many famous frameworks.

3.2 Research Framework's Improvements

The research framework provides solutions for other popular frameworks disadvantages some of them:

1. Allow developers to override framework's components.

2. Use JNDI connection.

3. develop framework that is able to work in many operating systems.

4. Develop framework that will access database meta data to create the table's headers.

5. Most types of forms be available in html library.

6. Develop Java framework.

7. develop framework without unnecessary features.

8. Use programing language that is common for most web developers.

Beside this improvement, this research's framework try to gain the main advantages of other frameworks to obtain the ideal framework.

3.3 Proposed System

To help the developers in the web development process, researchers decides to develop set of libraries which gives in its entirety the framework.

Figure 3.1 shows the research's web applications framework structure, the framework builds on three classes, HTML class which contains methods that create the web page components -for example, insert forms-, SQL class which contains methods that performs processes on application's database and also JavaScript class which contains methods of validations and JSP class all classes controlled by Manager class.
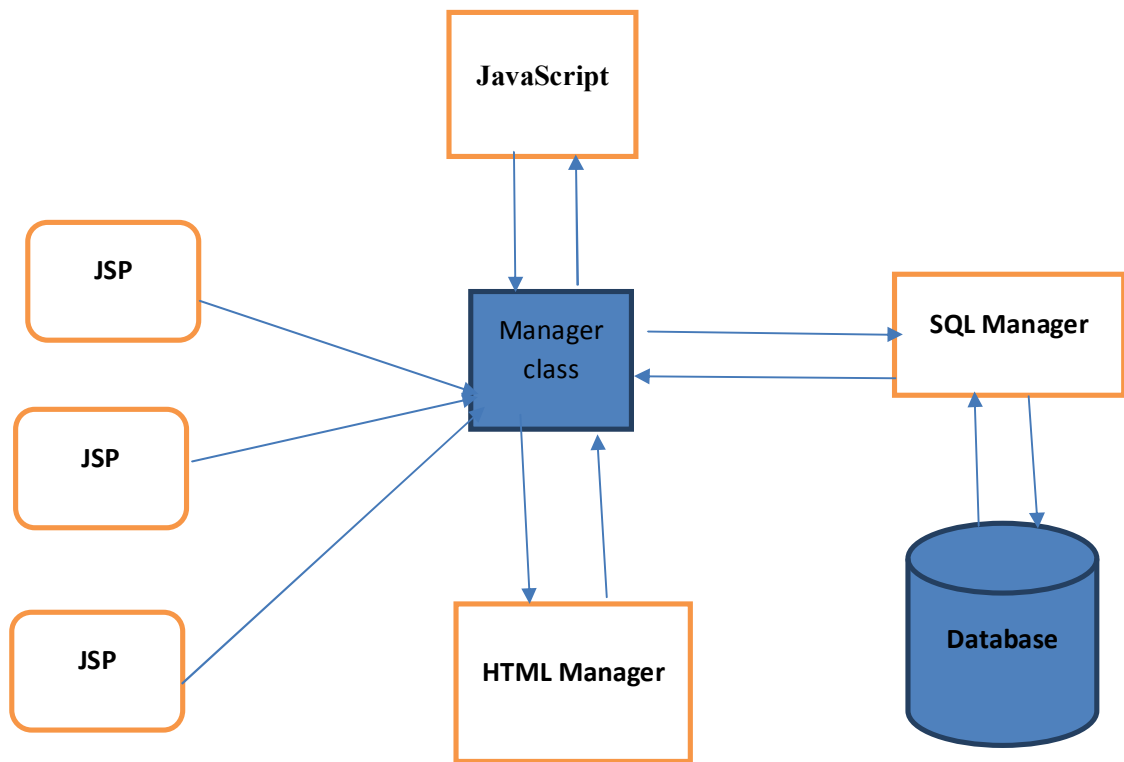

Figure 4.1 show the research's framework structure.

3.5 Tools

3.5.1 Apache Tomcat

Researchers conclude that, it is good to use tomcat as web server and if developers want free and open source servlet and JSP engine.

In the research because Apache tomcat server it is an open source and suitable for many use cases, it used tointerpret Servlets on which JSP files are based.

3.5.2 Enterprise Architect

In this research, Enterprise Architect used to create UML diagrams to design and analyze the research's framework.

3.5.3 UML (Unified Modeling Language)

In this research, UML class, sequence, use case and activity diagrams are used to design and analyze the research's framework.

3.5.4 Eclipse

By using Eclipse in this research as editor researchers deduced that, Eclipse has some perfect features -for example its open source IDE, extendable and faster run time- but there are also some bad features – for example Pretty heavyweight and Requires JRE-.

3.5.5 Java

This research's framework developed using java to solve problems with some frameworks available on internet written in programming language not popular for most developers and use to create the web application framework's libraries.

3.5.6 HTML5 (Hypertext markup language 5)

In this research HTML5 used for structuring and representing the content of web pages created by research's framework.

3.5.7 Servlet and JSP (Java Server Page)

In this research, servlet codes used to develop some components such as export and hot look ups, JSP use as scripting language for the web pages.

3.5.8 JavaScript

In this research, JavaScript used to extendfunctionality in websites, used in web's forms validation and on hot look ups component.

3.5.9 CSS (Cascade Style Sheet)

In this research, CSS used to define the style of website generated by research's framework.

3.5.10 MySQL

In this research, MySQL used to store data of student registration system as a case study to show how the research's web application framework works.

3.5.11 jQuery

In this research's framework, jQuery used to simplify some tasks such as make calendar for date input.

3.5.12 JSON (JavaScript Object Notation)

JSON is the best alternative to XML, it is a minimal, readable format for structuring data, and it can be used to transmit data between the server and the web application [21].

3.5.13 iText5

iText5 is a Java library use to create PDFs, read and maintain them. iText5 has hierarchical structure, the smallest text unit is the "chunk" which is the string with predefine font, a "phrase" combines several "chunks" and allow to define several lines spacing, a "paragraph" is a sub class of "phrase" and allows more layout attribute and "anchor" is sub class of "paragraph" and serve as basis for hyperlinks [22].

In this research, iText5 used to export PDF files but unfortunately its export English data in PDF form.

3.5.14 Apache POI (Poor Obfuscation Implementation)

Apache POI is a popular API that use to display, modify and create MS (Microsoft) files. It is an open source library developed and distributes by apache software foundation to design and modify Micro Soft office files by Java [23].

In this research, apache POI used to export WORD and EXCEL files in export component of the framework.

3.6 Chapter Summary

this chapter focused on the solutions of other frameworks disadvantages that the research's framework made, the proposed system features and the methodology of analysis and design and also provides a background and basic information about tools and techniques that used in the stage of project implementation. Next chapter contain the system analysis and design.

CHAPTER FOUR

System Analysis and Design

4.1 Introduction

The Analysis phase is a crucial phase of the project any minor mistake in this part will have massive ramifications over the project, delaying or halting progress or in some extreme cases the project could be scrapped.

Design phase is comprises a set of principles, concepts and practices which allow the software engineer to model the system or the product that is to be built.

This chapter describe the functional and non-functional requirements of the system and how the system will be analyzed and designed.

4.2 System Requirement

to develop the framework of a Web application, there are a number of functional requirements without which research's framework would not lead to the desired function and number of non-functional requirement which represent enhancement to the developed framework.

4.2.1 Functional Requirements

4.2.1.1 Insert Data Function

System must provide insert component that allow the developer to create insert forms that connected with the web application's database.

4.2.1.2 Display Data Function

System must provide display component that allow the developer to retrieve database's data and display it in form of data table on the web page which to be generated.

4.2.1.3 Update Data Function

System must provide update component which invoked by the developer in the web page which to be created to allow the end user to modify application's database table.

4.2.1.4 Delete Data Function

System must provide delete component which invoked by the developer in the web page which to be created to allow the end user to delete data from application's database table

4.2.1.5 Sort Data Function

System must provide sort component which invoked by the developer in the web page which to be created and support two types of sort and they are ascending and descending.

4.2.1.6 Search Data Function

System must provide search component which invoked by the developer in the web page which to be created to allow the end user to search for specific database table's rows and support two types of search and they are exact and contain.

4.2.1.7 Export Data Function

System must provide export component which invoked by the developer in the web page which to be created and support three types of exports PDF, WORD and EXCEL.

4.2.1.8 Pagination Data Function

developer select number of rows to be displayed, by provide pagination end user can move between pages each of which display specific number of rows.

4.2.2 Non-Functional Requirement

4.2.2.1 Portability

The users shall be able to use the platform from anywhere.

4.2.2.2 Usability

Users should have no trouble using the platform with maximum ease of use as possible also a very fast learning curve.

4.2.3 Features on Functional Requirements

4.2.3.1 Forms Validations

For each input field system, should allow developer to specify which field must have validation.

4.2.3.2 Session Management

The session of each web page created by the research's web application framework must be stored, when the end user moves from one web page to another and return to the first one again all processes he was performed before moving to second web page will be saved.

4.2.3.3 Insert on Grade

System can allow the developer to make insertion but directly on the displayed table; as with insert component the data of insert on grade component will be stored in application's database.

4.2.3.4 Update on Grade

System can allow the developer to make updates but directly on the displayed table; as with update component the data of update on grade component will be updated and stored in application's database.

4.2.3.5 Look Up

System should allow the developer to specify form's fields which require LOVs (List of Values).

4.2.3.6 Hot Look Up

System should allow the developer to specify form's fields which based on another fields.

4.2.3.7 Generate page Menus

System should allow developer to generate pages' menu to allow end user to move across web site's pages.

4.3 System Analysis

4.3.1 System Analysis Using UML

4.3.1.1 Use Case Diagram

The Following diagram describes the main functionality of researcher's framework.
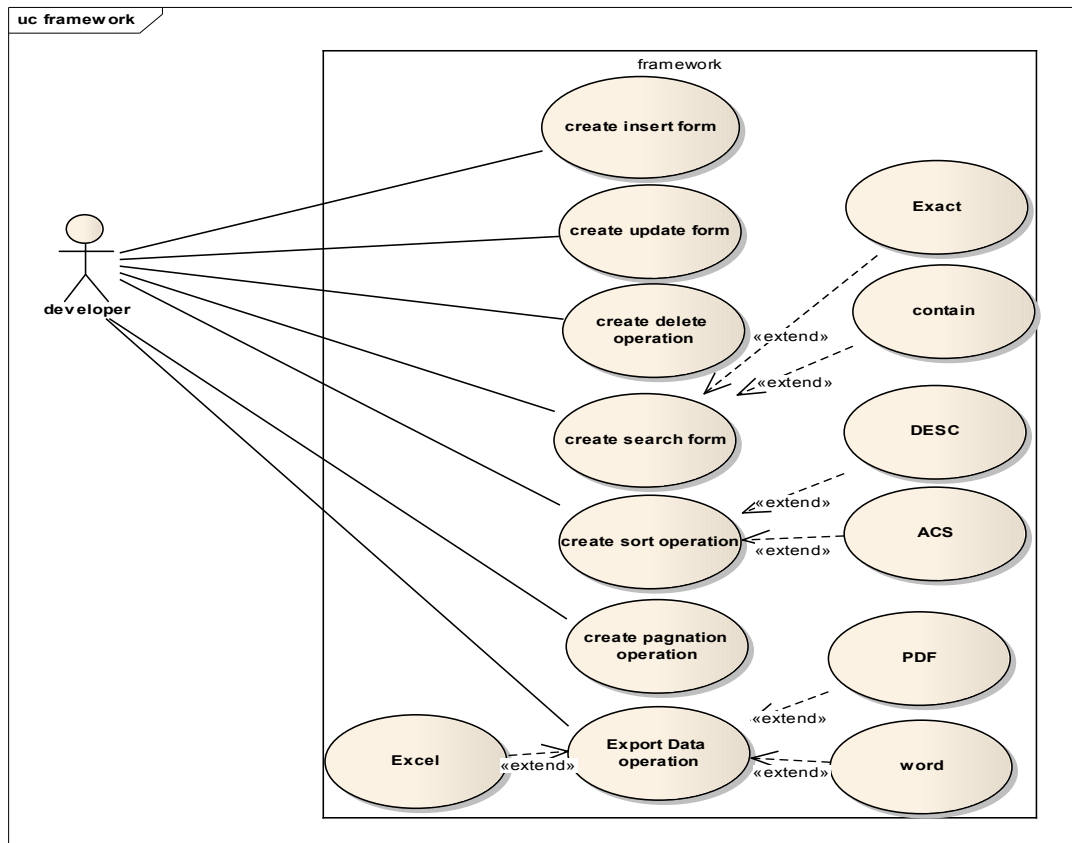
Figure 4.1 framework's Use Case Model

4.3.2.2 Activity Diagram

There is no mandatory sequence of processes to be followed by web developer when he uses the web application framework, developer can use components he needs it and leaves others, because of that there is activity diagram for each component of web applications framework.
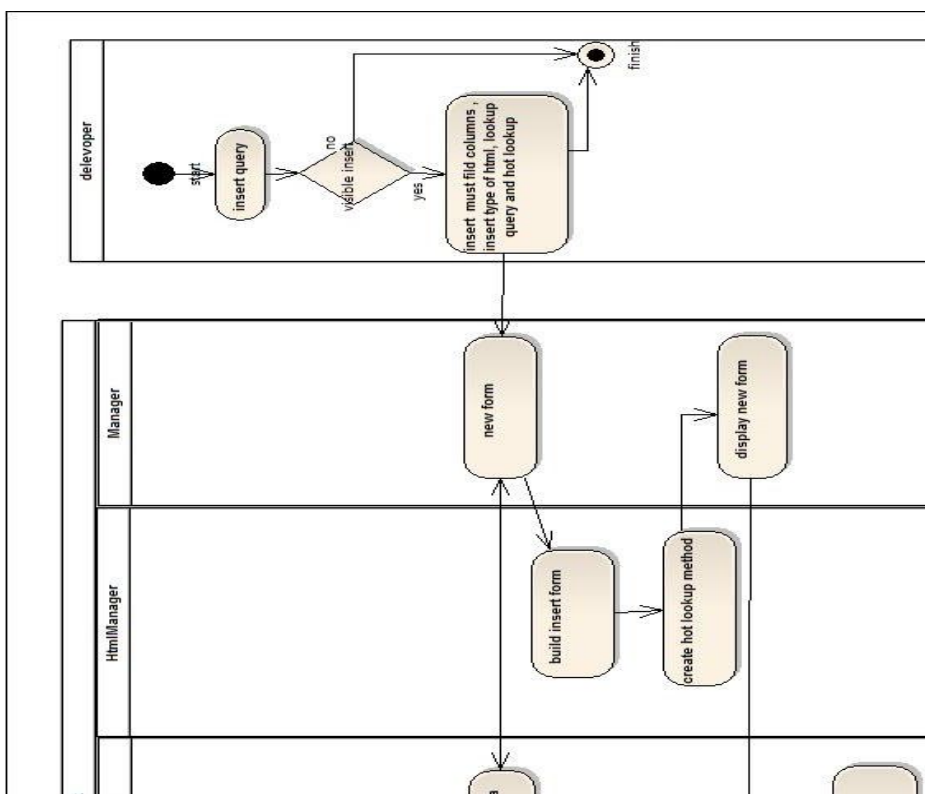
Figure 4.2 Insert component activity
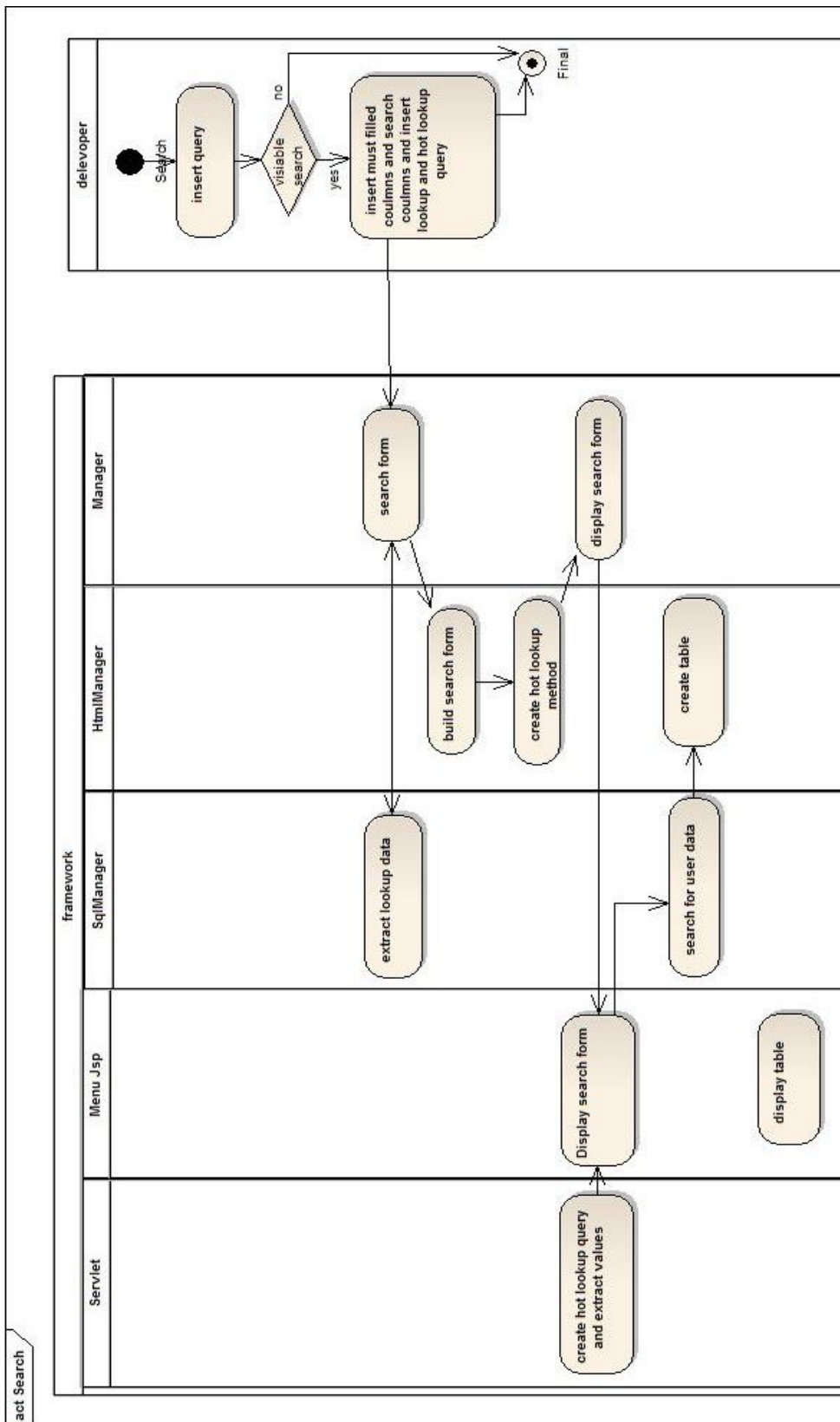
Figure 4.3 search component activity

31
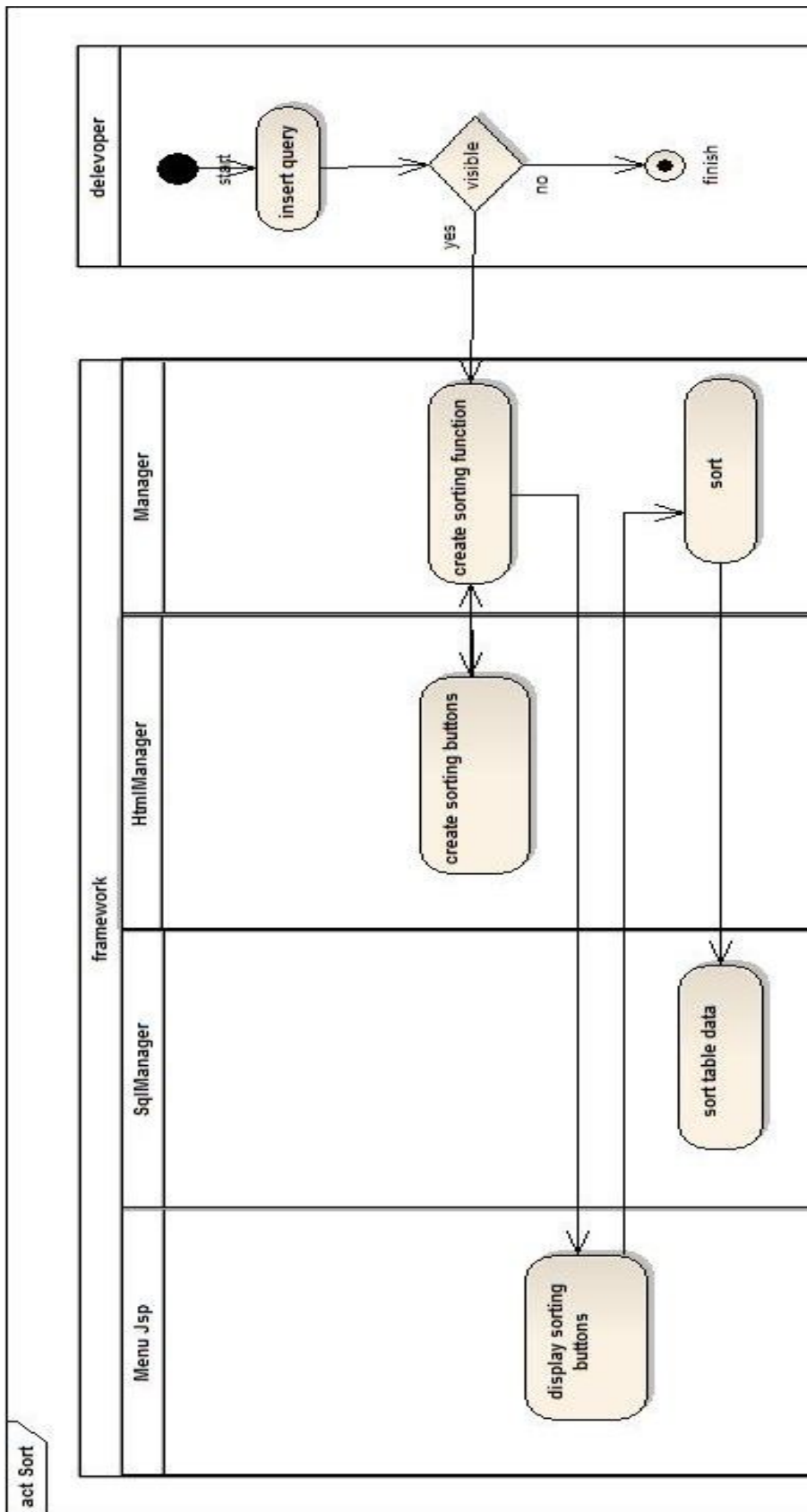
Figure 4.4sort component activity
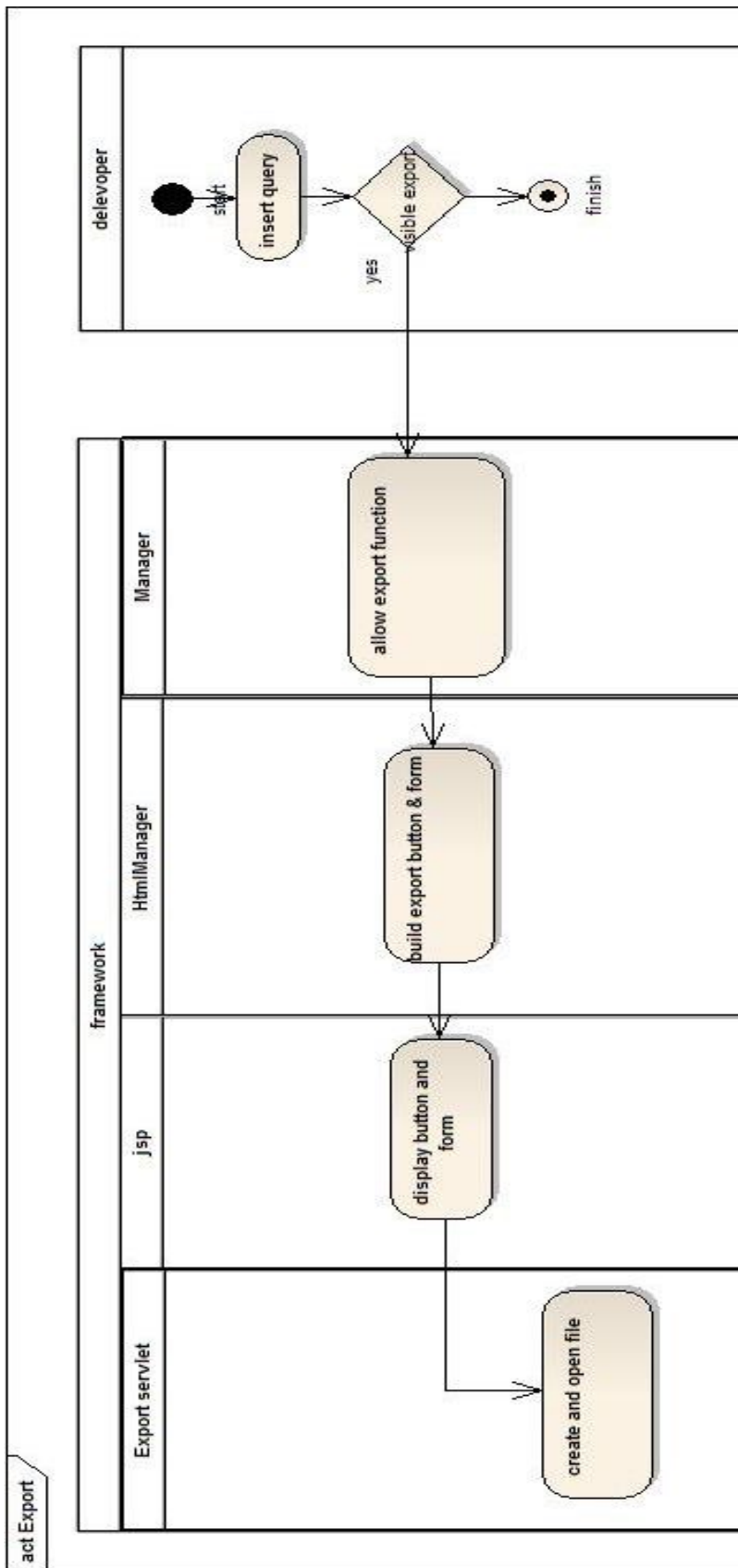
Figure 4.5 Export component activity

33
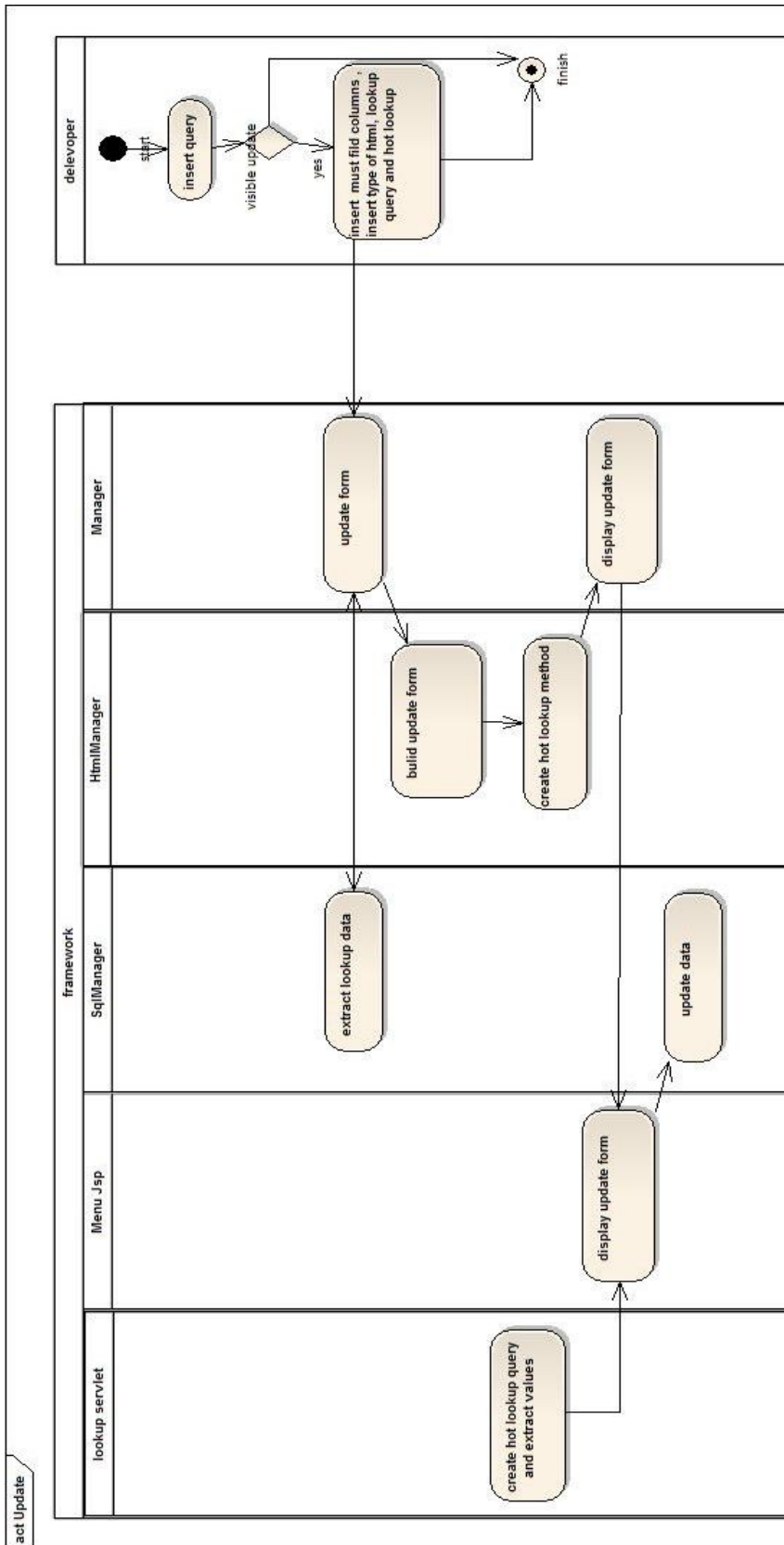
Figure 4.6 Update component activity

34
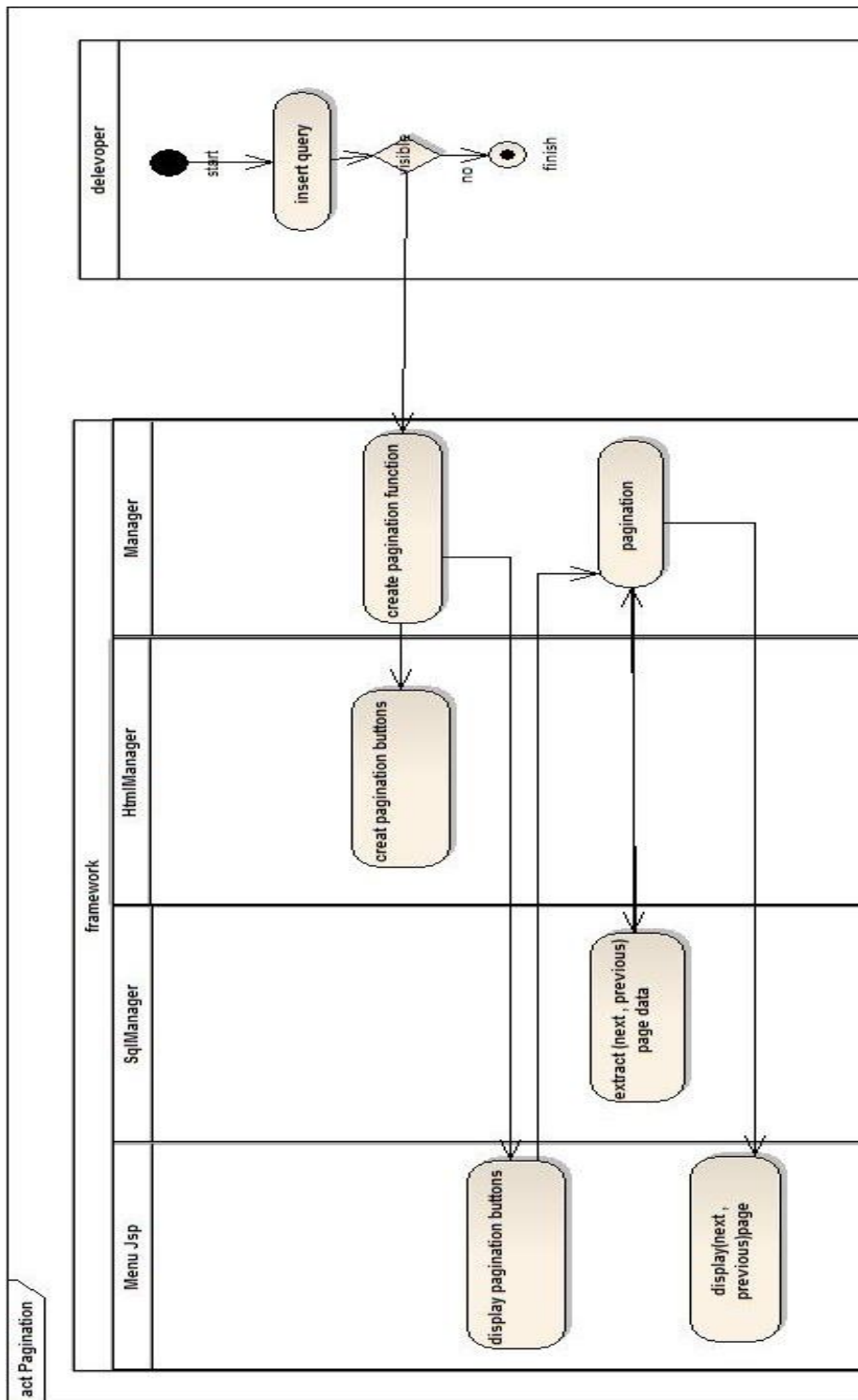
Figure 4.7 Pagination component activity diagram

4.3 System Design

4.3.1 Class Diagram

This Diagram describes the entire system and the interaction between classes.
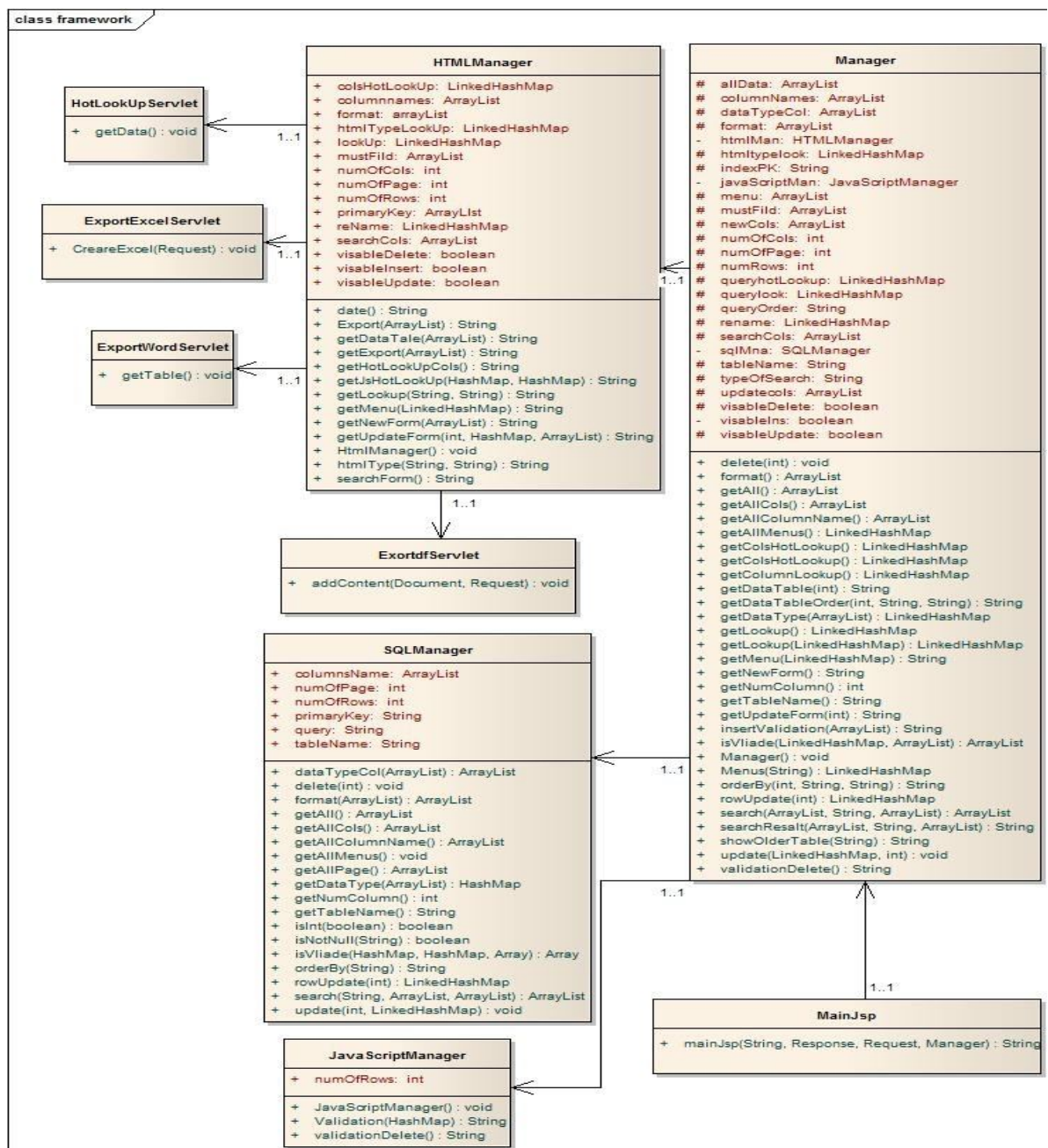
Figure 4.8 framework classes' interaction
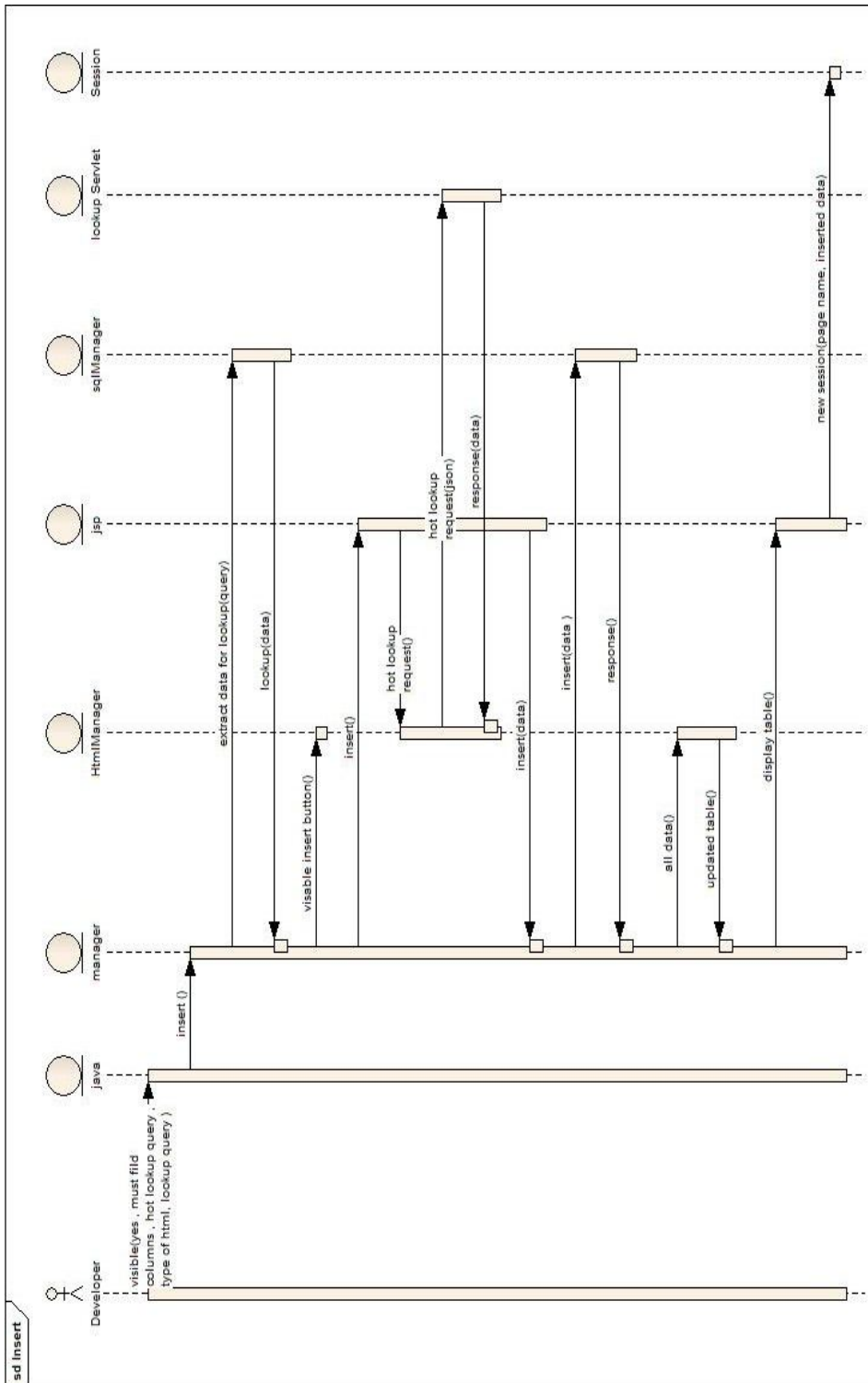
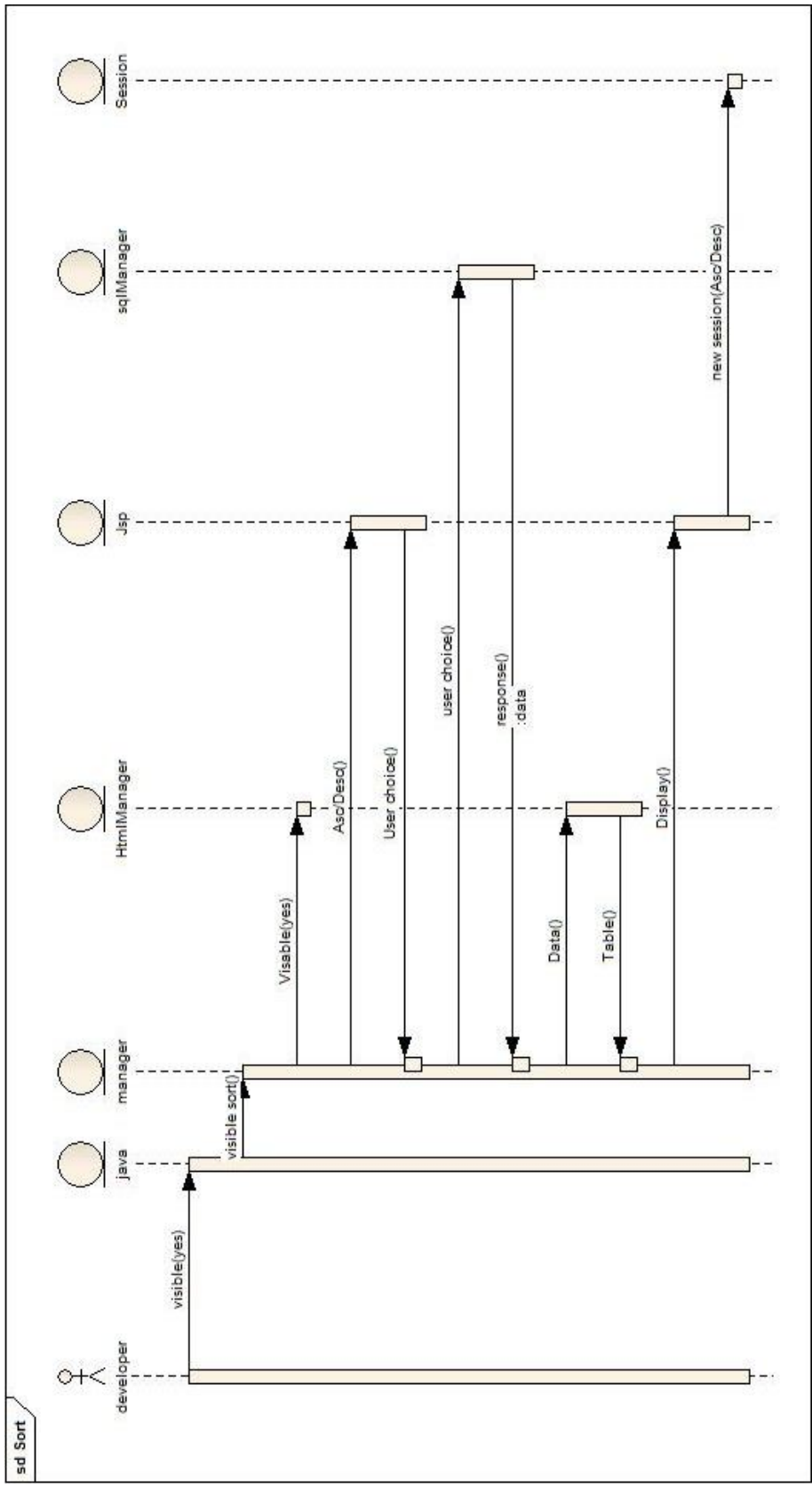Figure 4.9 Insert component sequence
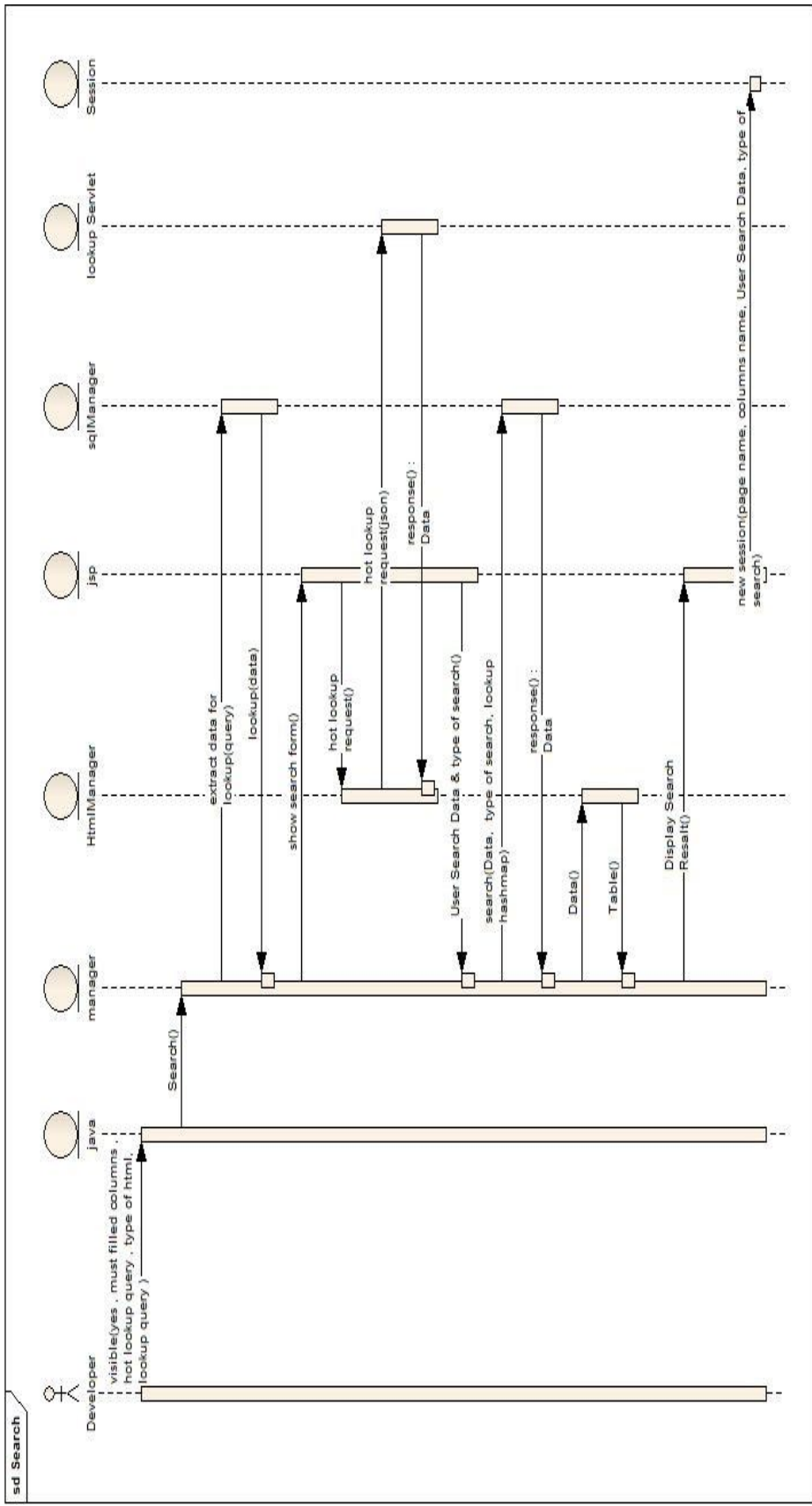
Figure 4.10 Search component sequence

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Figure 4.11 Sort component sequence
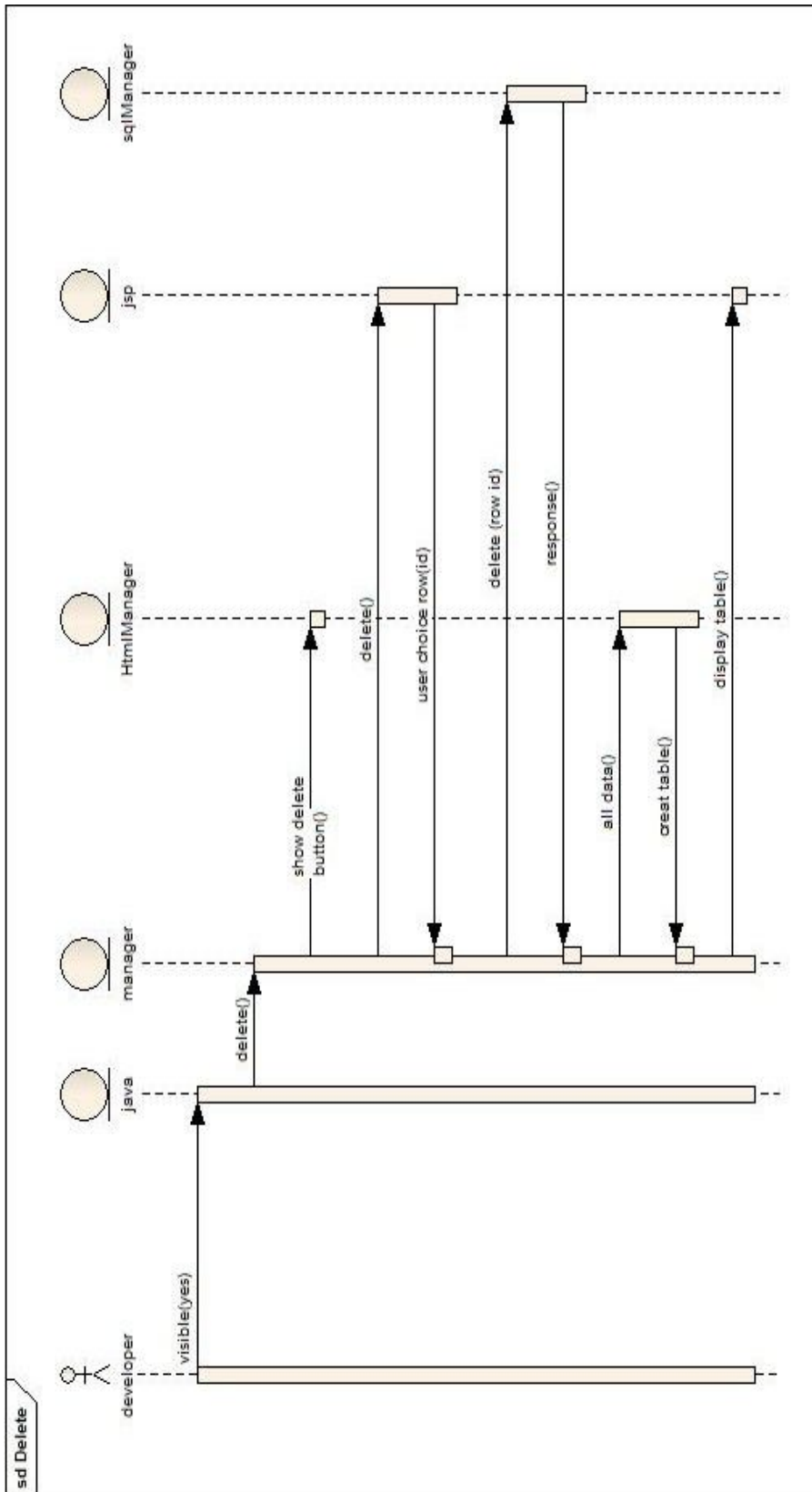
Figure 4.12 Delete component sequence
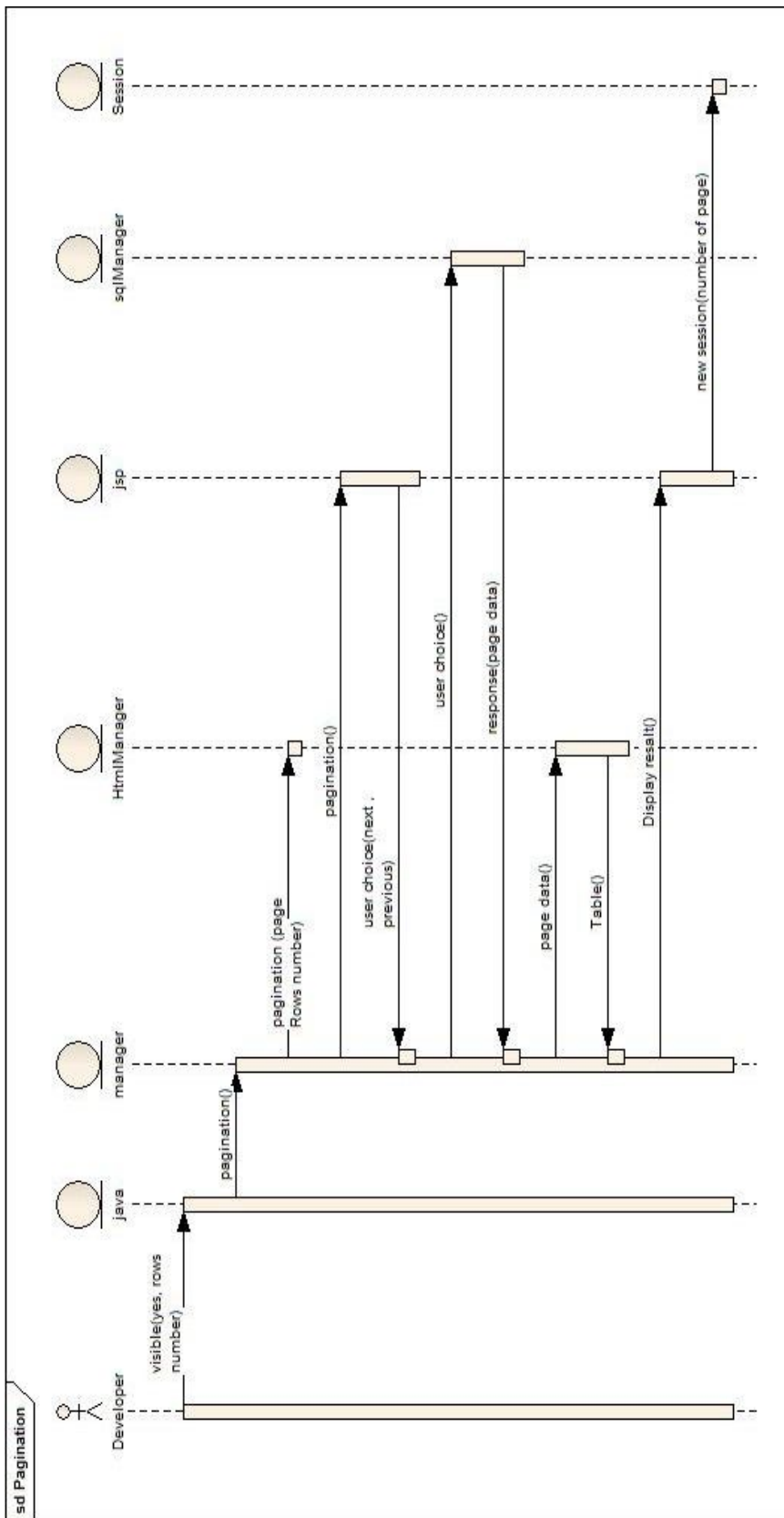
Figure 4.13 Pagination component sequence diagram

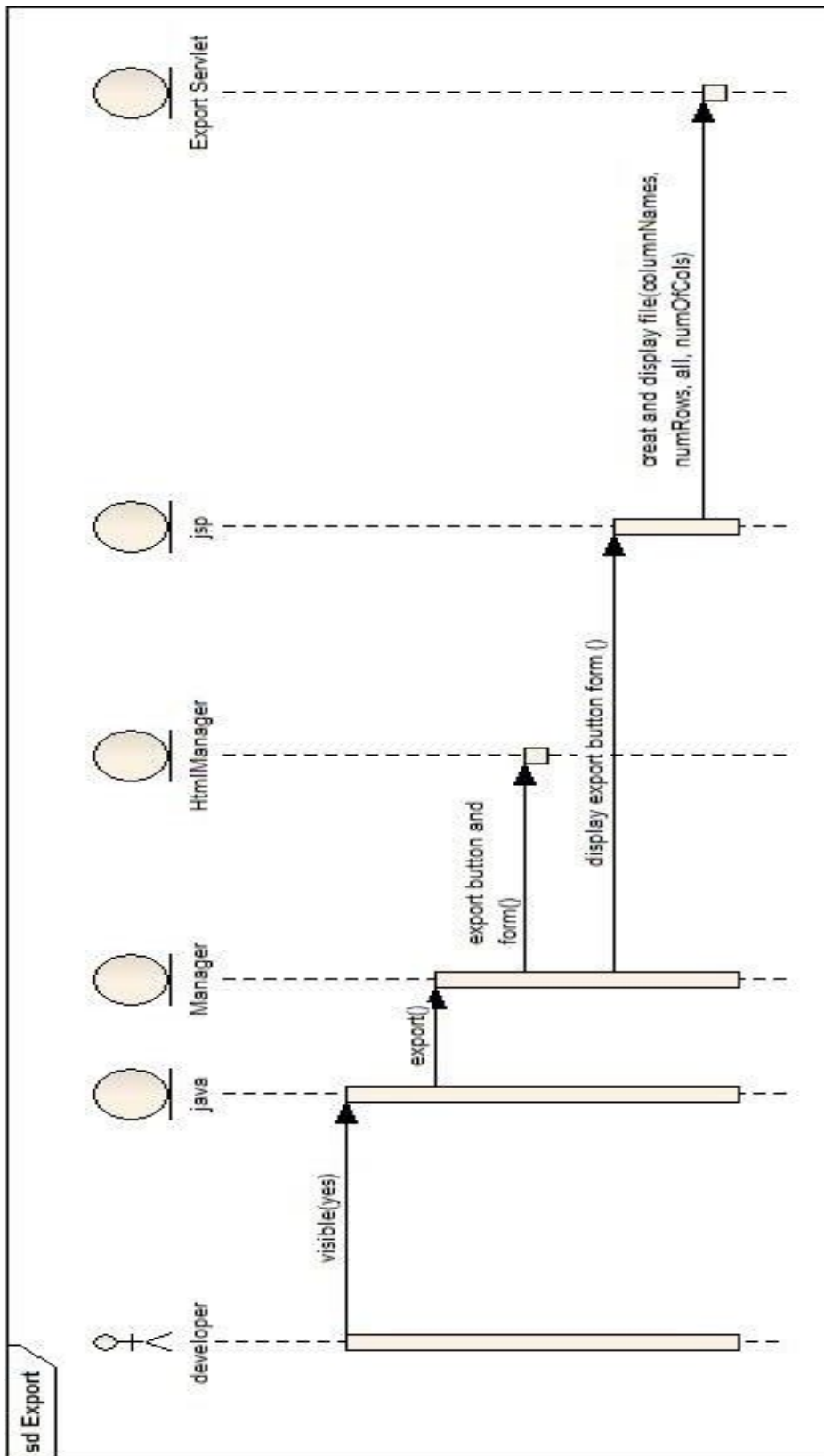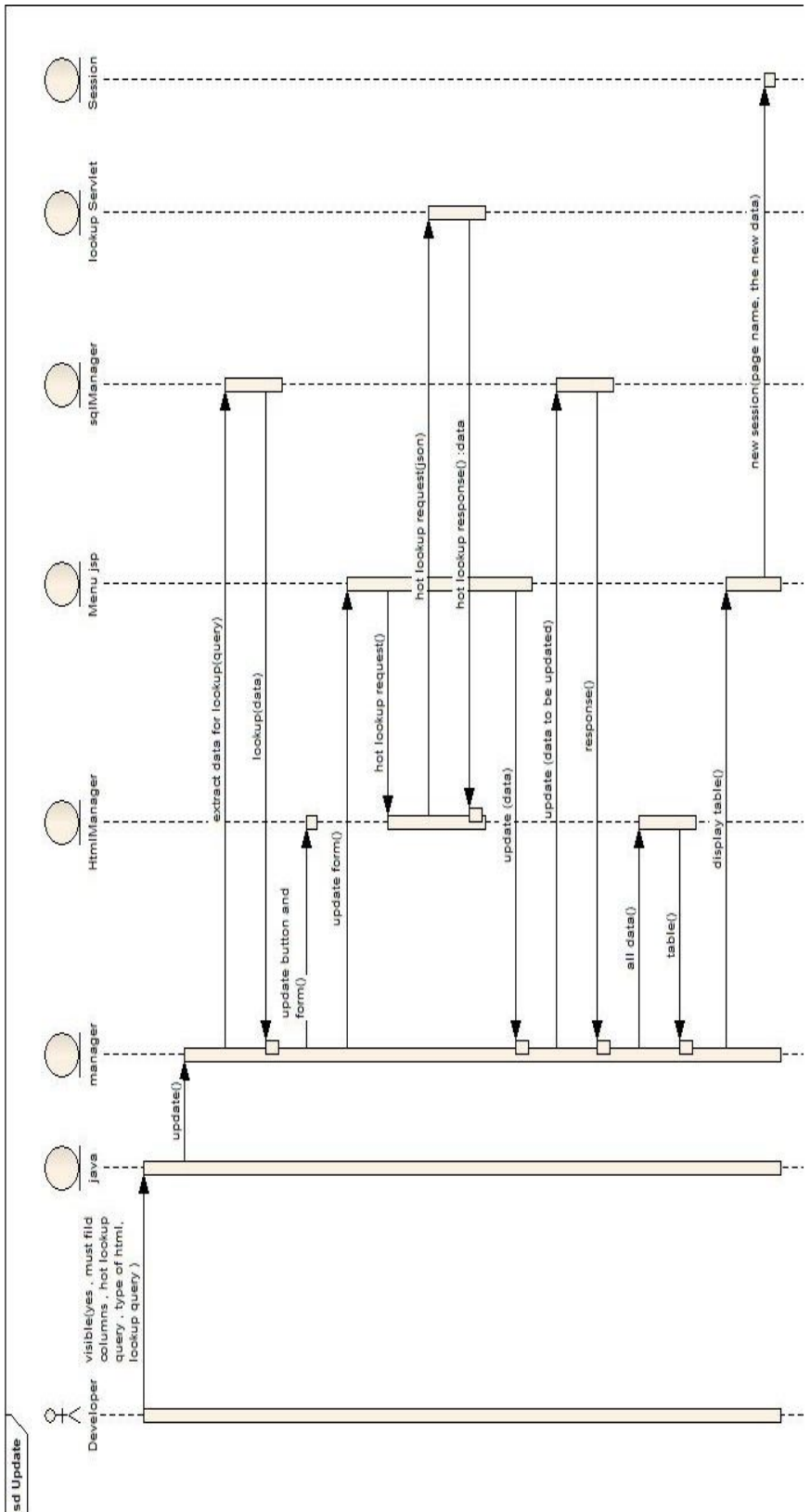Figure 4.14 Export component sequence

43

Figure 4.15 Update component sequence diagram

4.4 Chapter Summary

In this chapter researchers describe the analysis of the proposed system using use case and sequence diagrams for the framework components and also the design of it using class and activity diagrams. Next chapter contain the implantation of the proposed system in term of system screens and how system works.

CHAPTER FIVE

Implementation

5.1 Introduction

This chapter shows the implementation steps of this software and some of the testing it using student registration web application.

5.2 How System Work

5.2.1 Implementation Steps

To use the web application framework, developer must write three codes shown in the next three figures.

The web developer must write this code to select the components of new web page he wants to create researchers called this code as" web application setting".
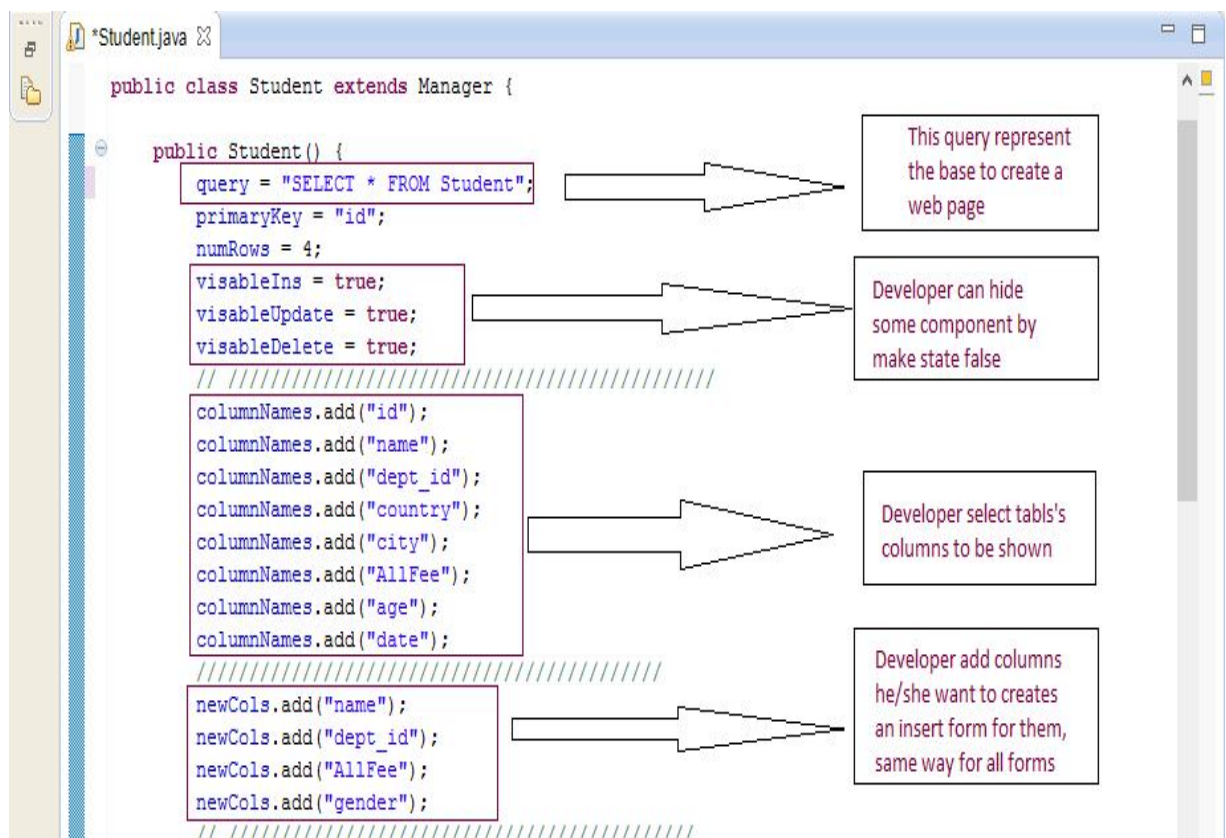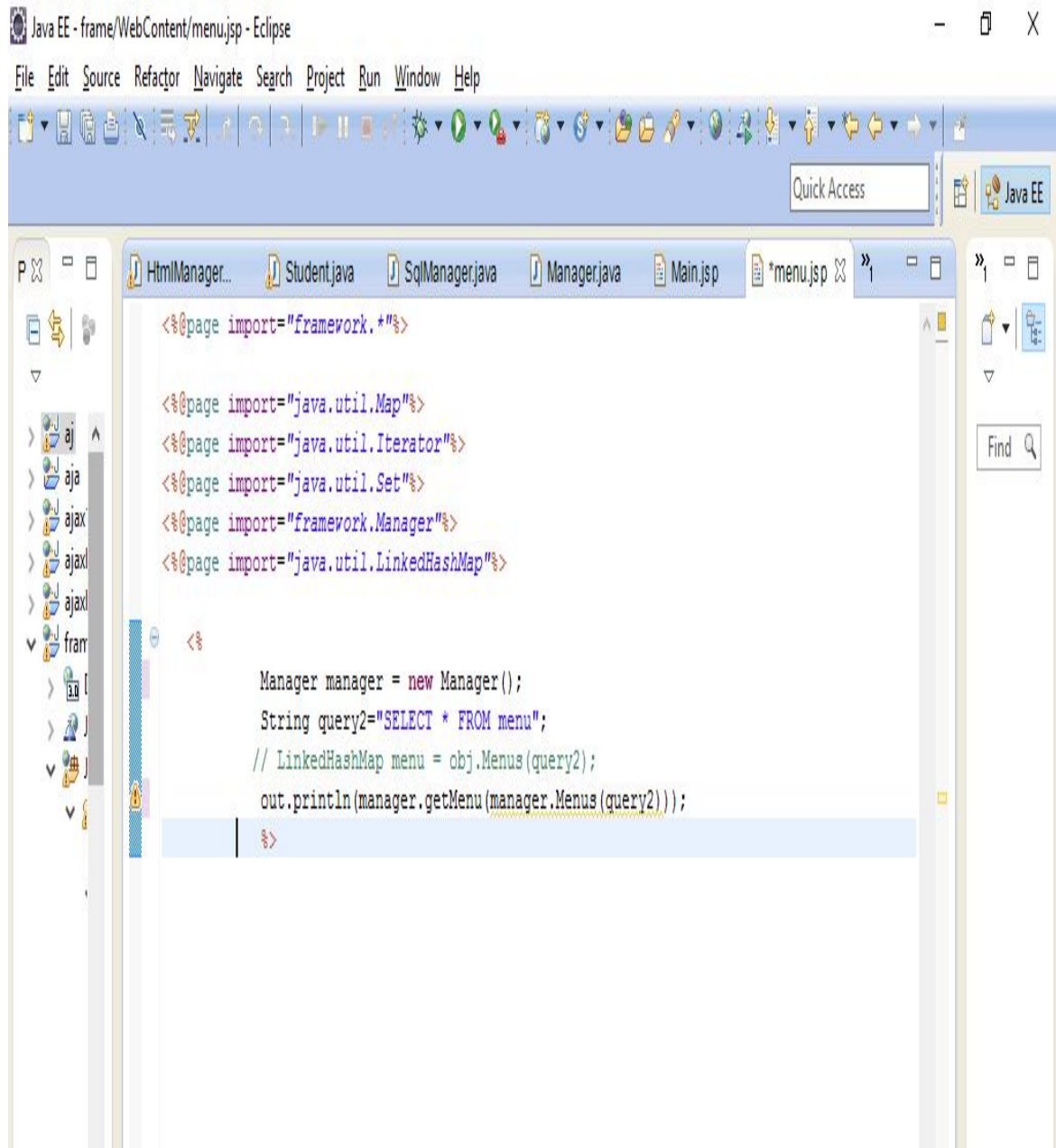

Figure 5.1 web application setting.

Developer will only write the following code to generate the new web application's menu that connect two or more web pages together.


```
<%@page import="framework.*"%>

<%@page import="java.util.Map"%>
<%@page import="java.util.Iterator"%>
<%@page import="java.util.Set"%>
<%@page import="framework.Manager"%>
<%@page import="java.util.LinkedHashMap"%>


<%

        Manager manager = new Manager();
        String query2="SELECT * FROM menu";
        // LinkedHashMap menu = obj.Menus(query2);
        out.println(manager.getMenu(manager.Menus(query2)));
        %>
```

Figure 5.2 menu generation code.

For each web page there is no need to write huge HTML5, JavaScript, jQuery or JSP codes, only with two lines of code plus four JSP include statements the desired web page will be created with components specified in "setting code" which showed previously in figure 5.1.

Figure 5.3 show the code that developer must write to create the web page.

5.2.2 Testing The Web Framework

To test that the framework works perfect and in line with the pre-specified requirements, small student registration web application used as case study to show how to use the research's framework to create web applications. Based only on the codes written by developer in figure 5.1, figure 5.2 and

figure 5.3 the following web pages will be created; its components will be invoked from prewritten libararies.

This page shows the "display component", through which developer can retrive the database table's data without need to write lot lines of codes.
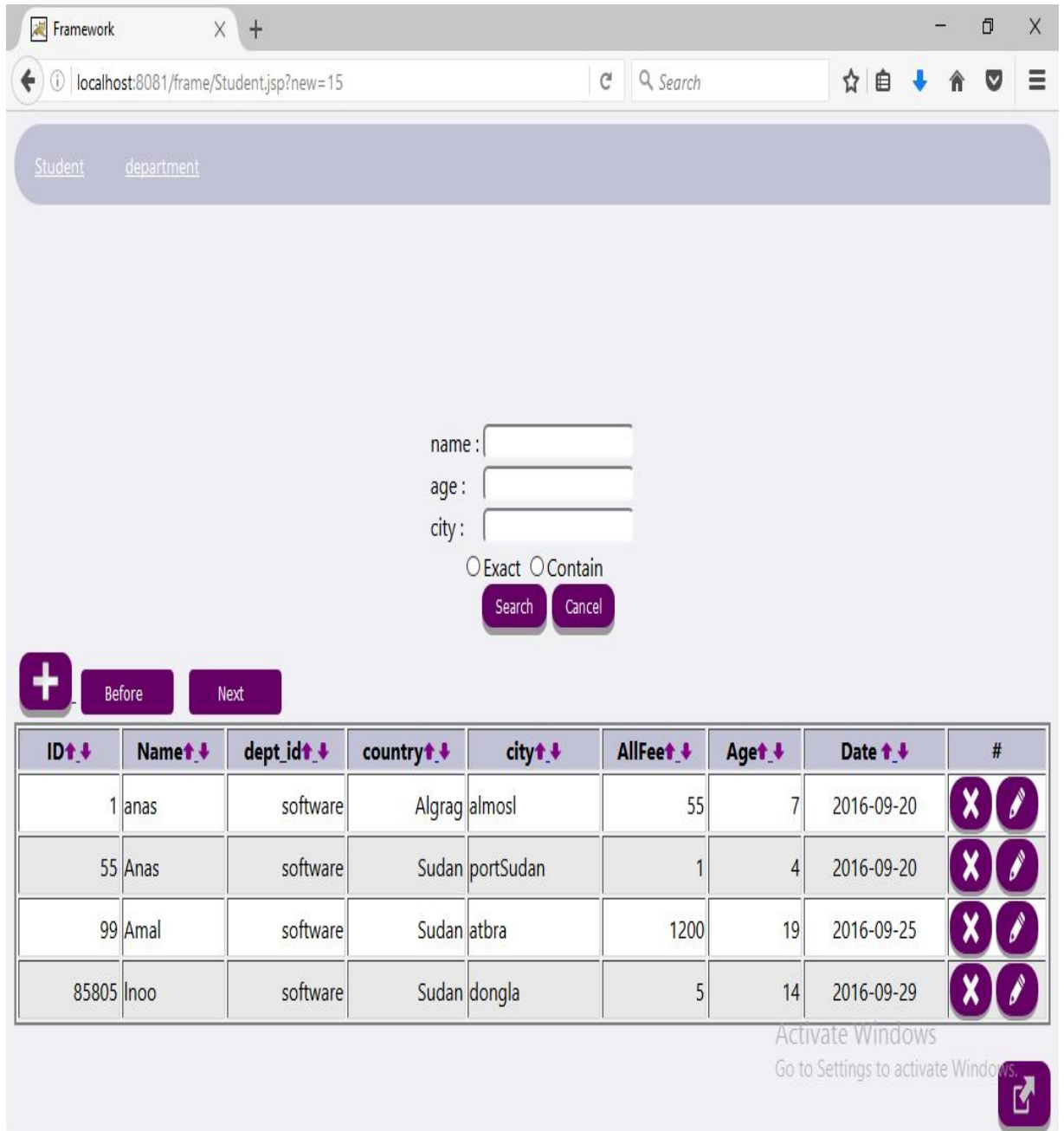
Figure 5.4 show "display component".

Without write any HTML5, JavaScript or JSP codes except codes showed in previous figures, dynamic search form will be created, when data inserted to it and the search type has selected, the data table will changed to contain the searched data only, as showed previously the developer didn't write database's search query.
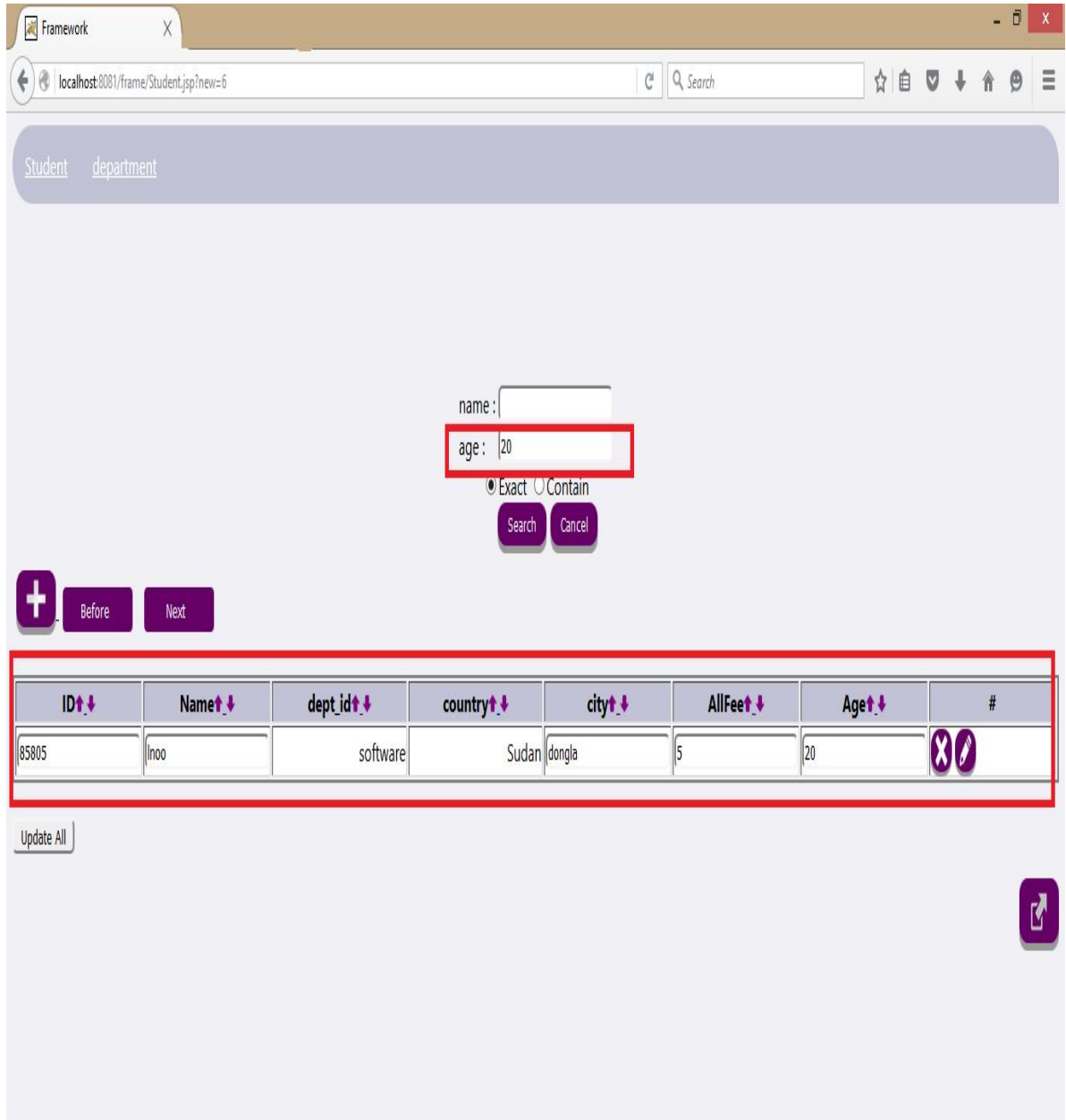
Figure 5.6 show "search component" created on the web page based on developer's commands

When the developer gives the value true for the Boolean variables in "setting class" code in figure 5.1 which specify the components visibility, delete and update component will become visible and when press on delete button of specific row, the row will be deleted from the database table and certainly from the currently displayed table on the web page, the same thing will be done for update component.

Figure 5.7 show "delete and update components" buttons created on the web page based on developer's commands.

Based on developer command for component's visibility, insertion button will be created, if the end user press this button then new page will appear which will be shown in figure 5.9.
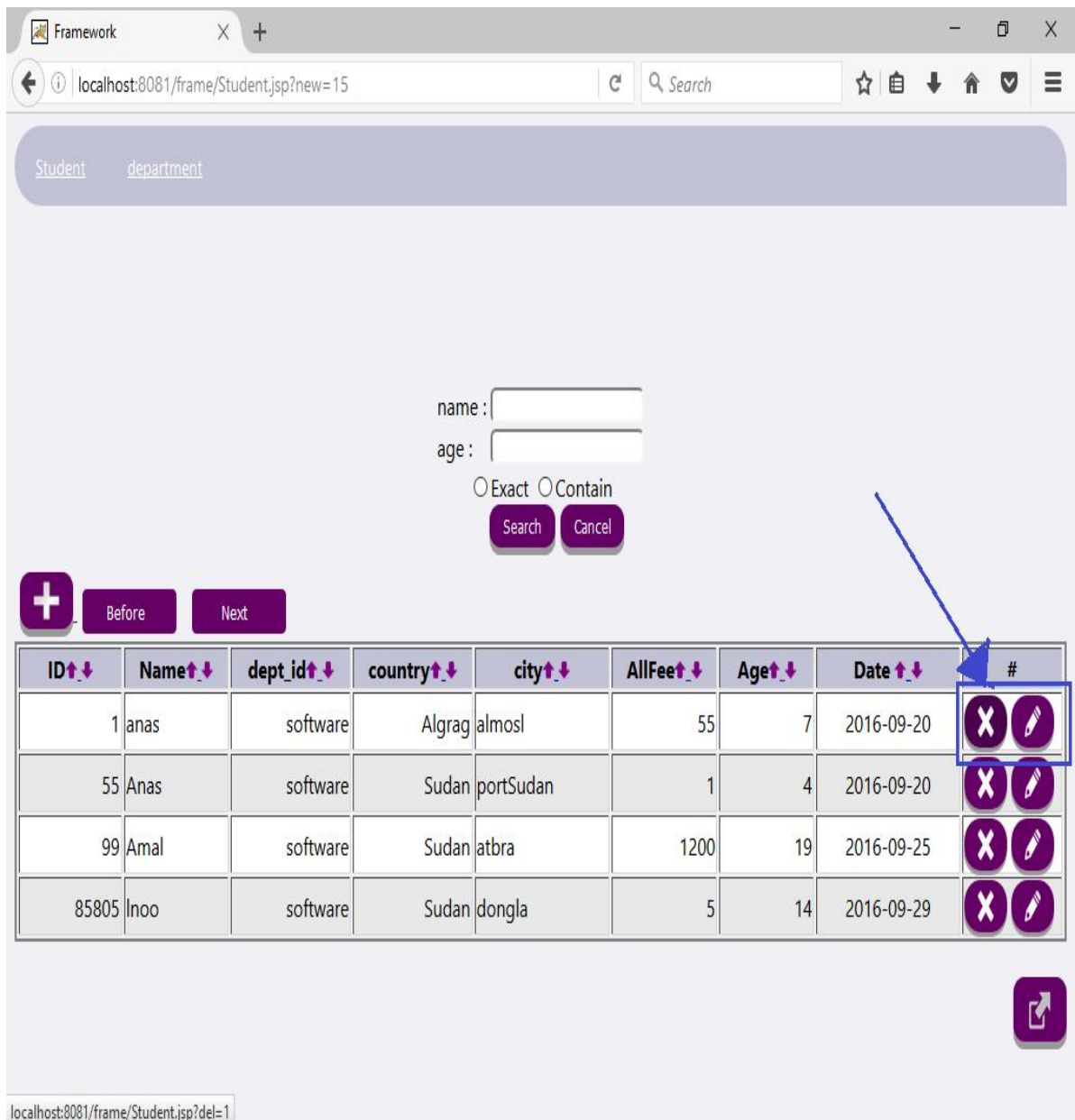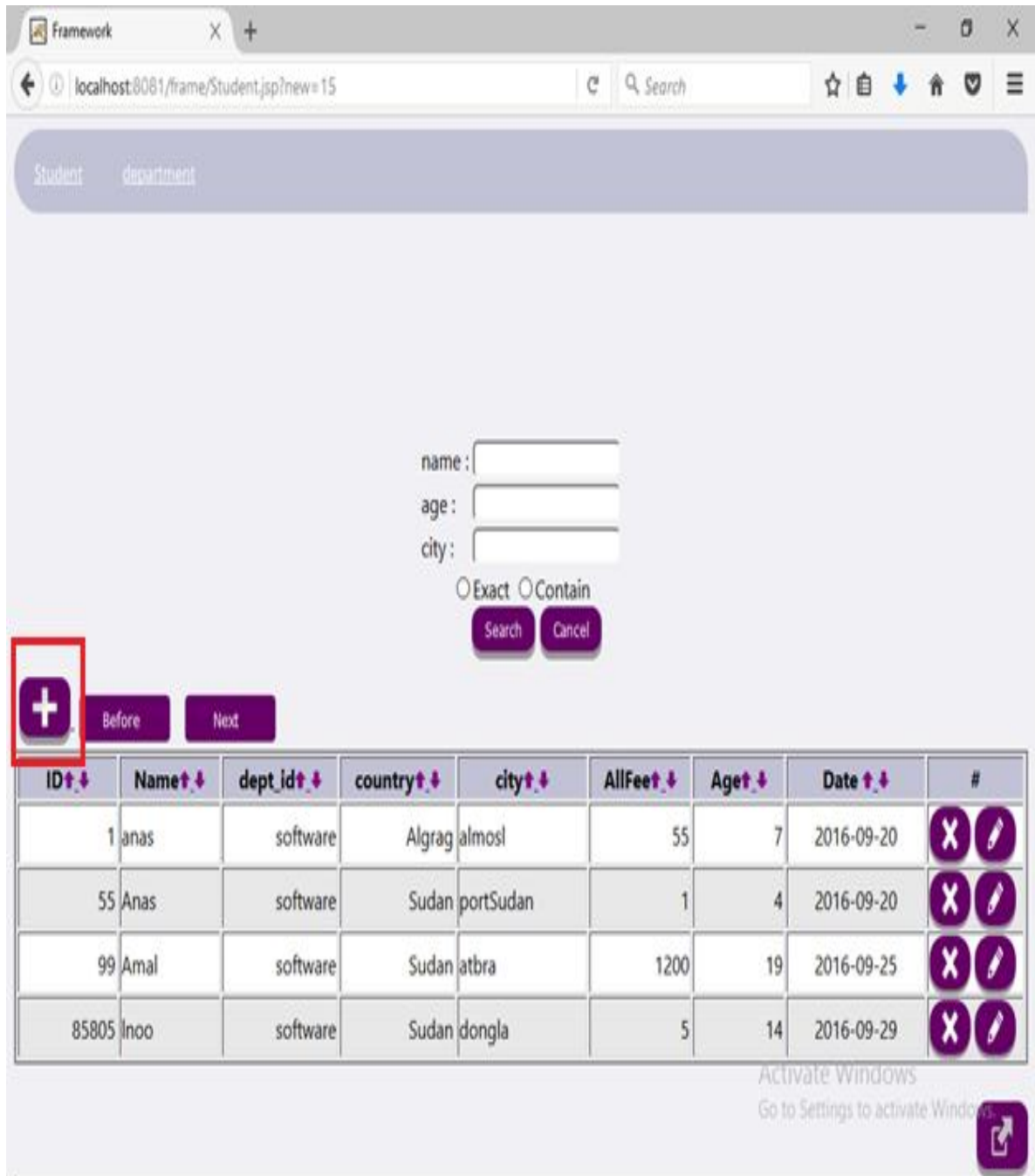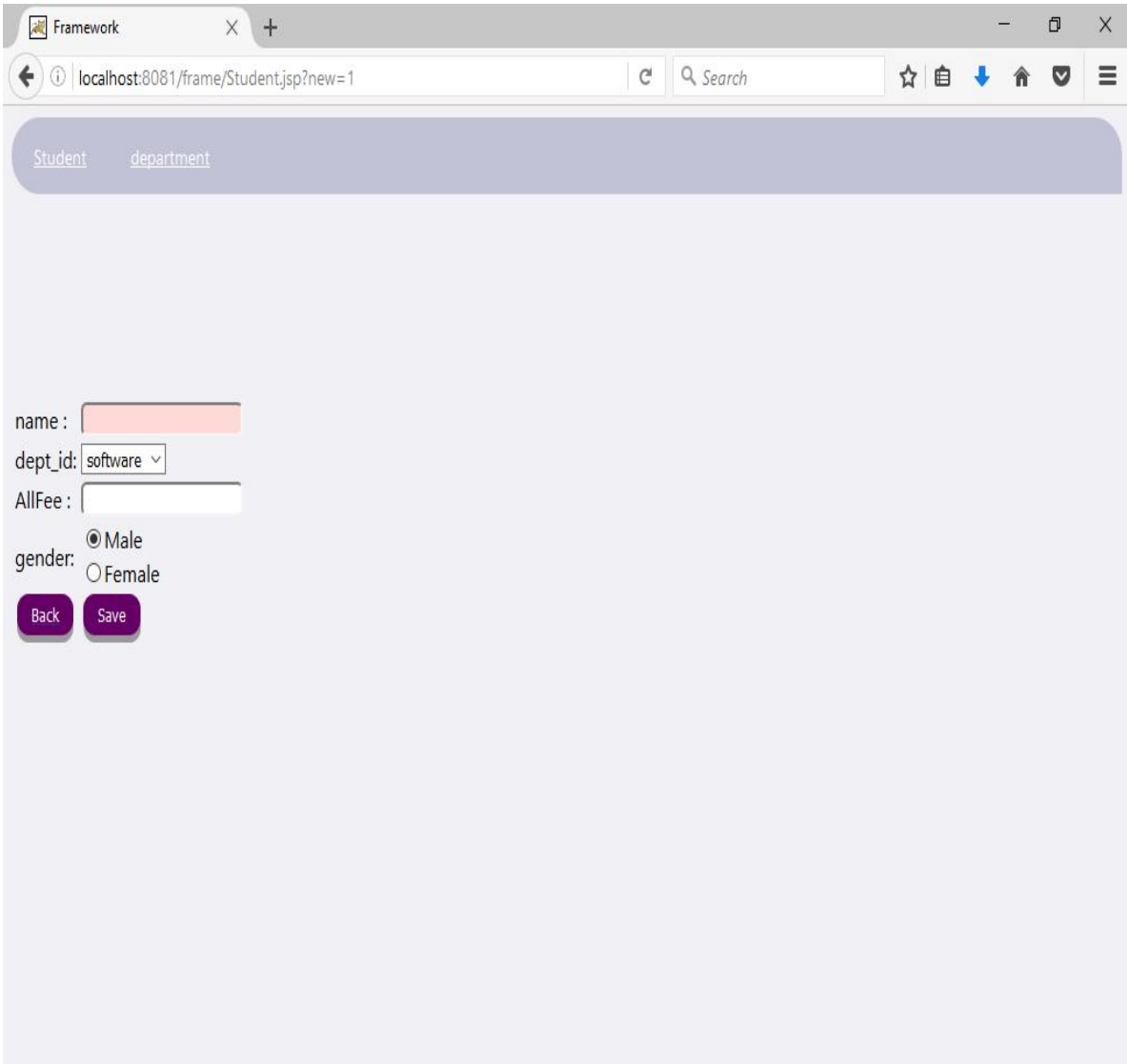

Figure 5.8 show the insertion button created based on developer's commands.

the Developer will write only the name of data table's columns he wants to create insertion form for them, select which of them need validation – colored with red in this case study-, select which fields need hot look ups -for example, the value in AllFee will based on value selected from dept_id – , select which fields will have look ups -as in gender field – and when save button pressed the data on those fields will inserted in the application's database without need to write complex jQuery, ajax, JavaScript validation code, HTML5 or any sever side language codes to connect with the database.

Figure 5.9 show the "insert component" created on the web page based on developer's commands.

Because it is bad idea to display all database table's rows in one screen, the research's framework enable developer to select number of rows he wants to display on one screen, the other rows accessed through pagination buttons.

In this case study we supposed that developer selected five rows to be displayed on each screen, when next button pressed the next five rows will be shown and when before button pressed the previous five rows will be shown.
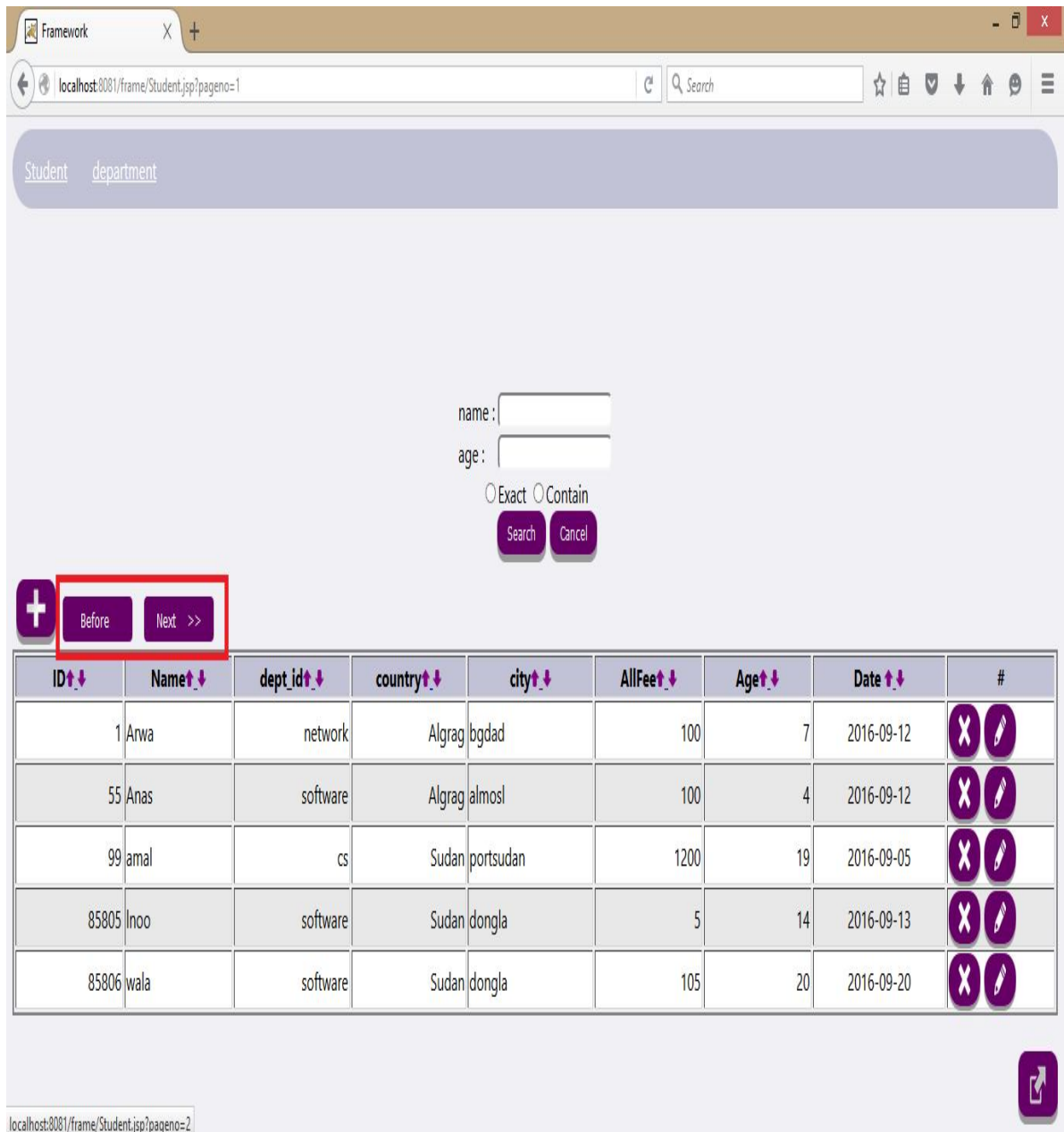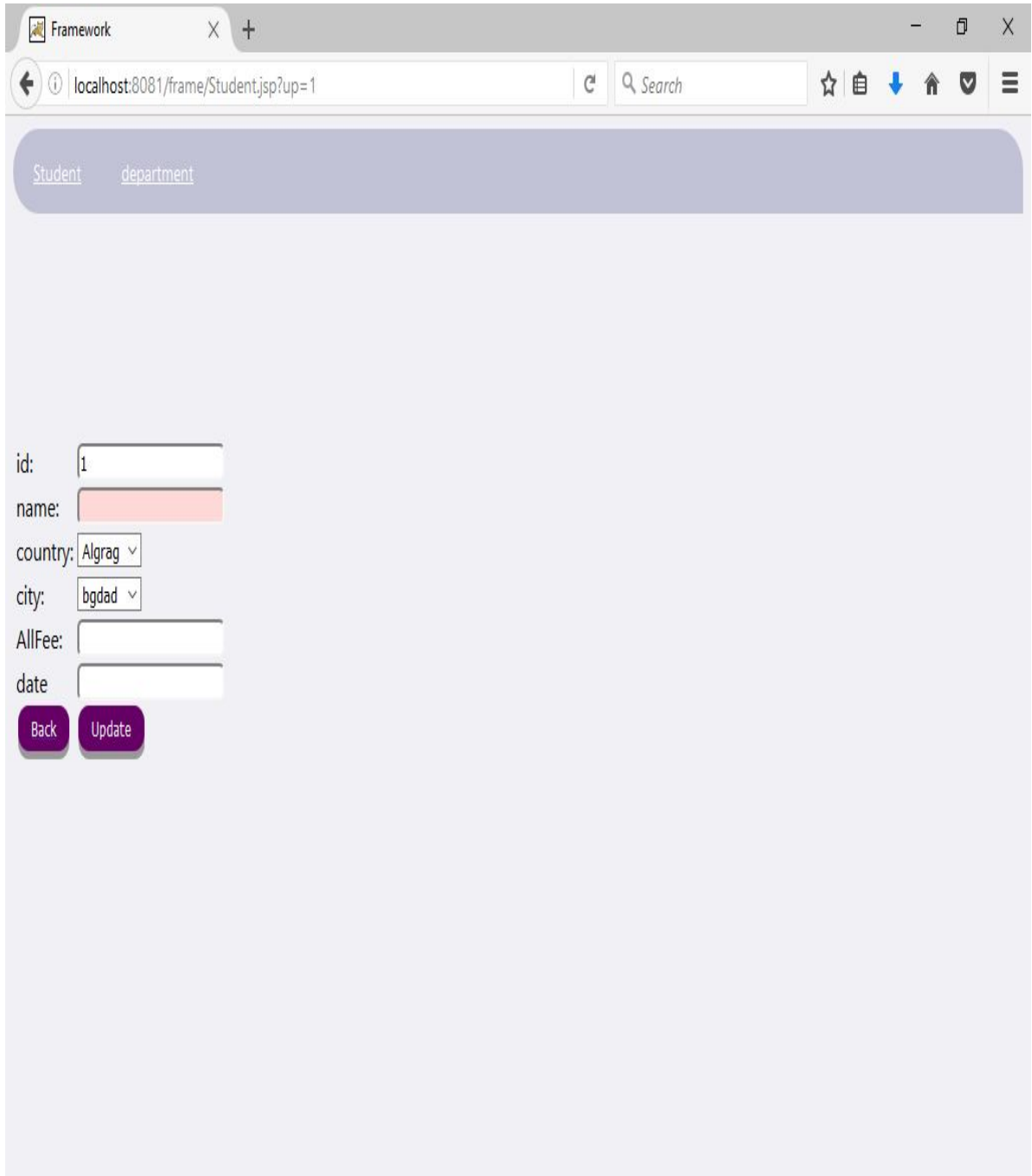
Figure 5.10 show "pagination component" buttons created on the web page based on developer's commands.

When the developer presses update button which showed in figure 5.7 this page will be displayed. Here the power of this framework will be clear, the developer will specify the fields with validation, look up or hot look up only one time and this will be done automatically when those fields appear again.

Figure 5.11 show update component's page created based on developer's commands.

Without any jQuery codes written by the developer, if the data type of the database's column was date the field will be created with a calendar.
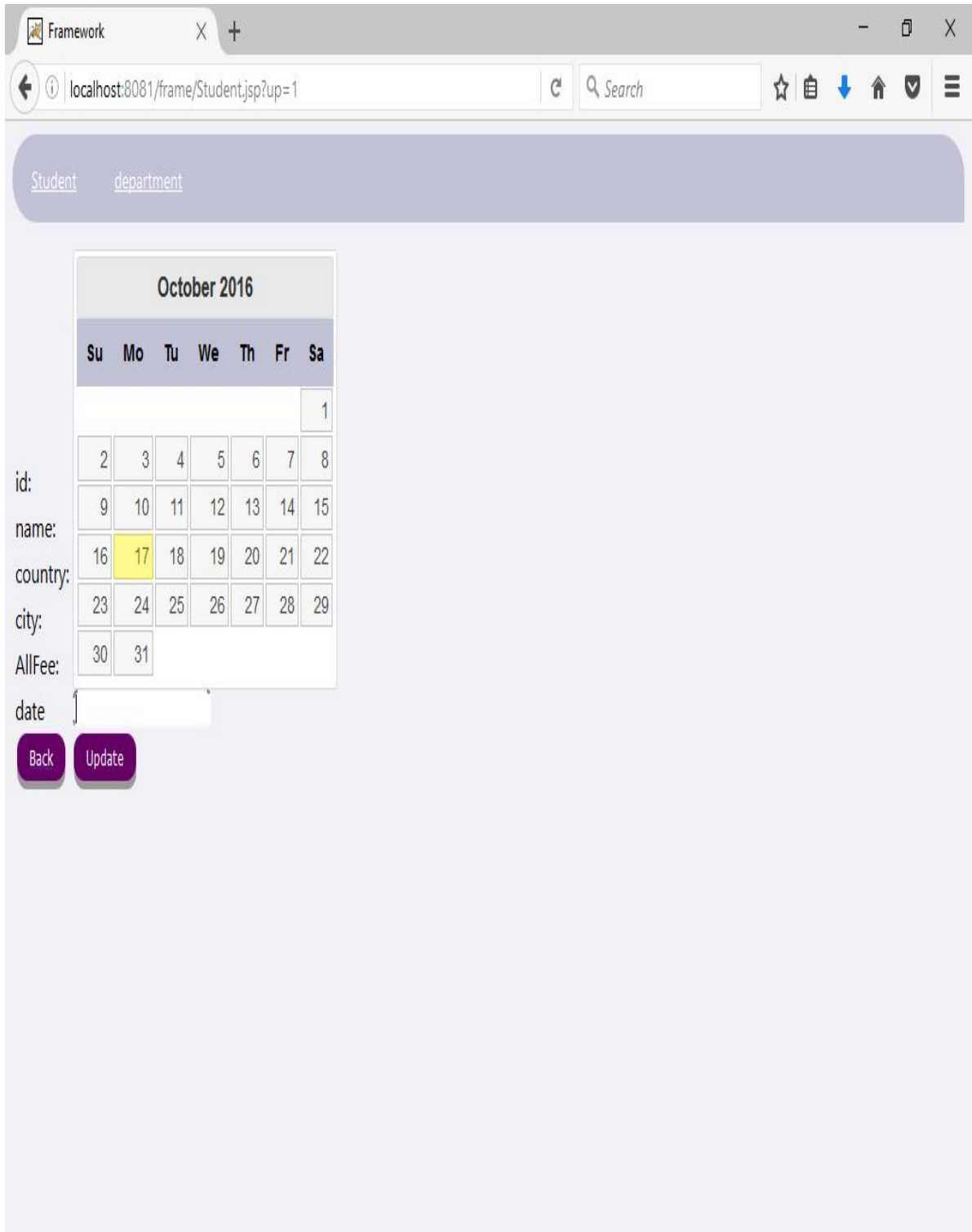
Figure 5.12 show calendar on table column with data type "date".

Developer selects the column's names thought which data table can be sorted ASC (ascending)or DESC (descending), when sort button pressed the data of the table will be sorted without need to write any database query for sort by the developer.
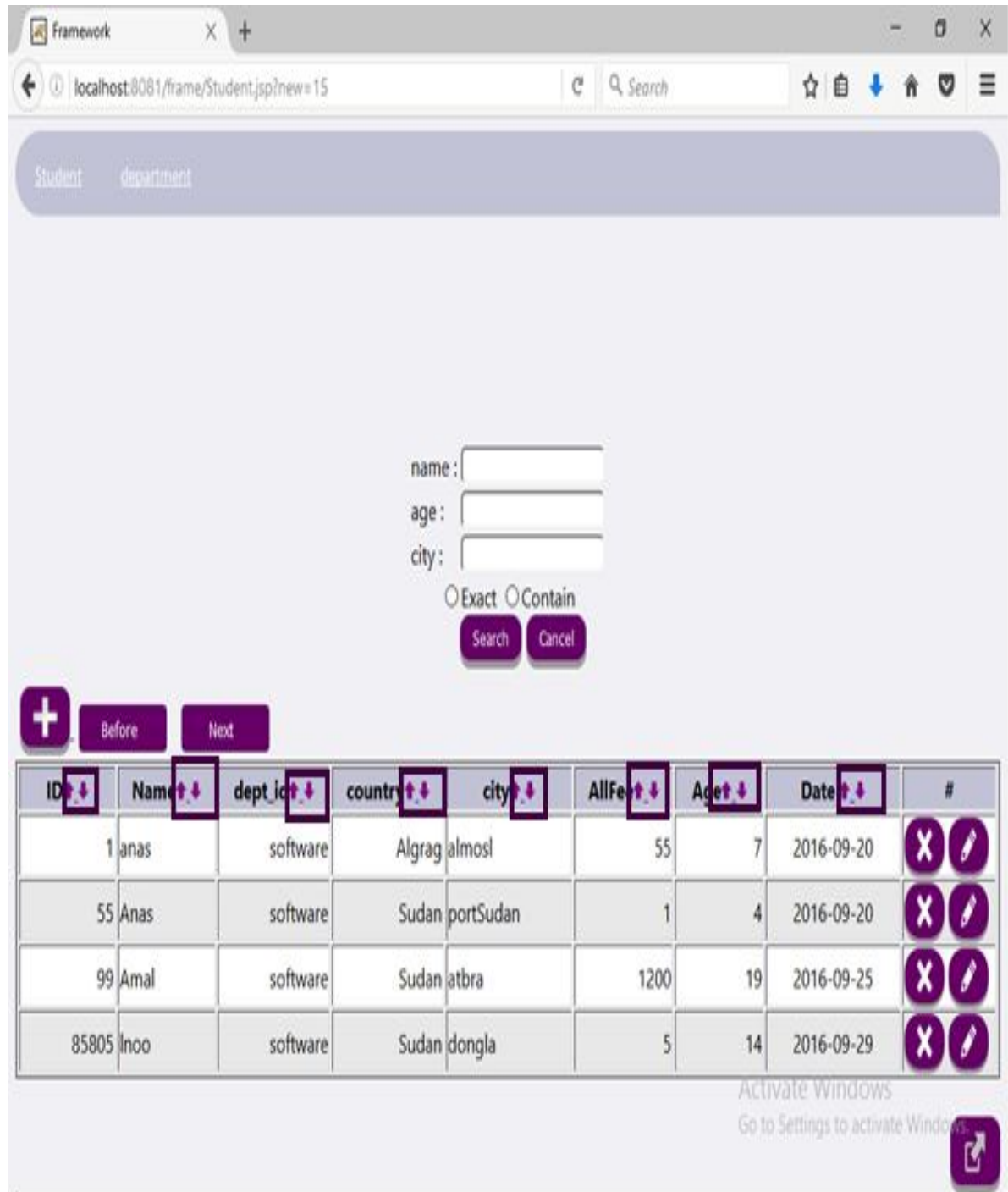
Figure 5.13 show "sort component" created on the web page based on developer's commands.

This research's framework provides advanced feature calls "update on grade", when update all button pressed by the end user of the web application you can see that all the table become editable and user can update more than one row simultaneously. To make this button visible, developer set the button's state *true* in setting's code.
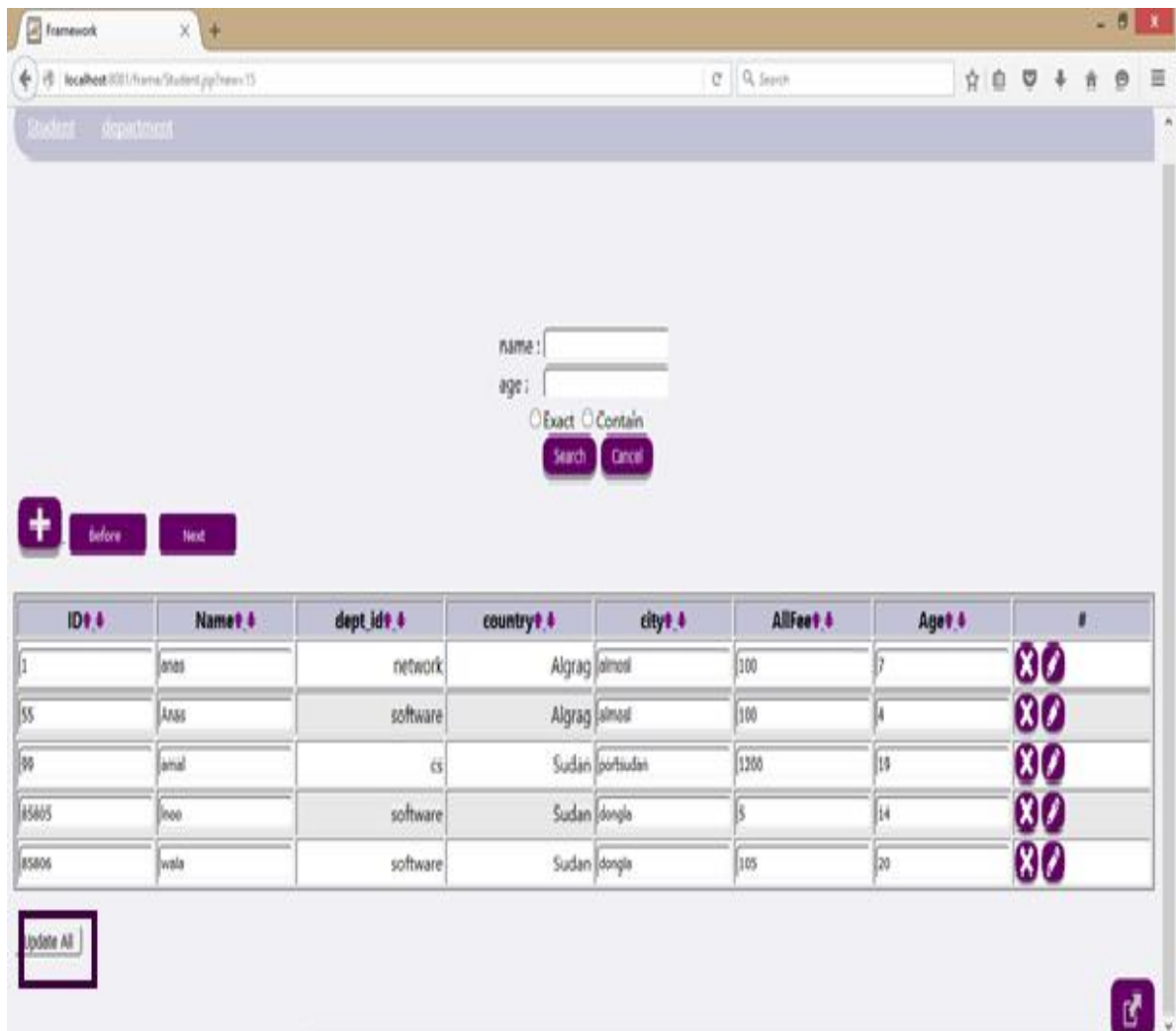
Figure 5.14 show "update on grade component" created on the web page based on developer's commands.

When the developer makes the export component visible, the export button will be created on the web page and when the end user presses it three type of exports will be able which they are (WORD, PDF and EXCEL).
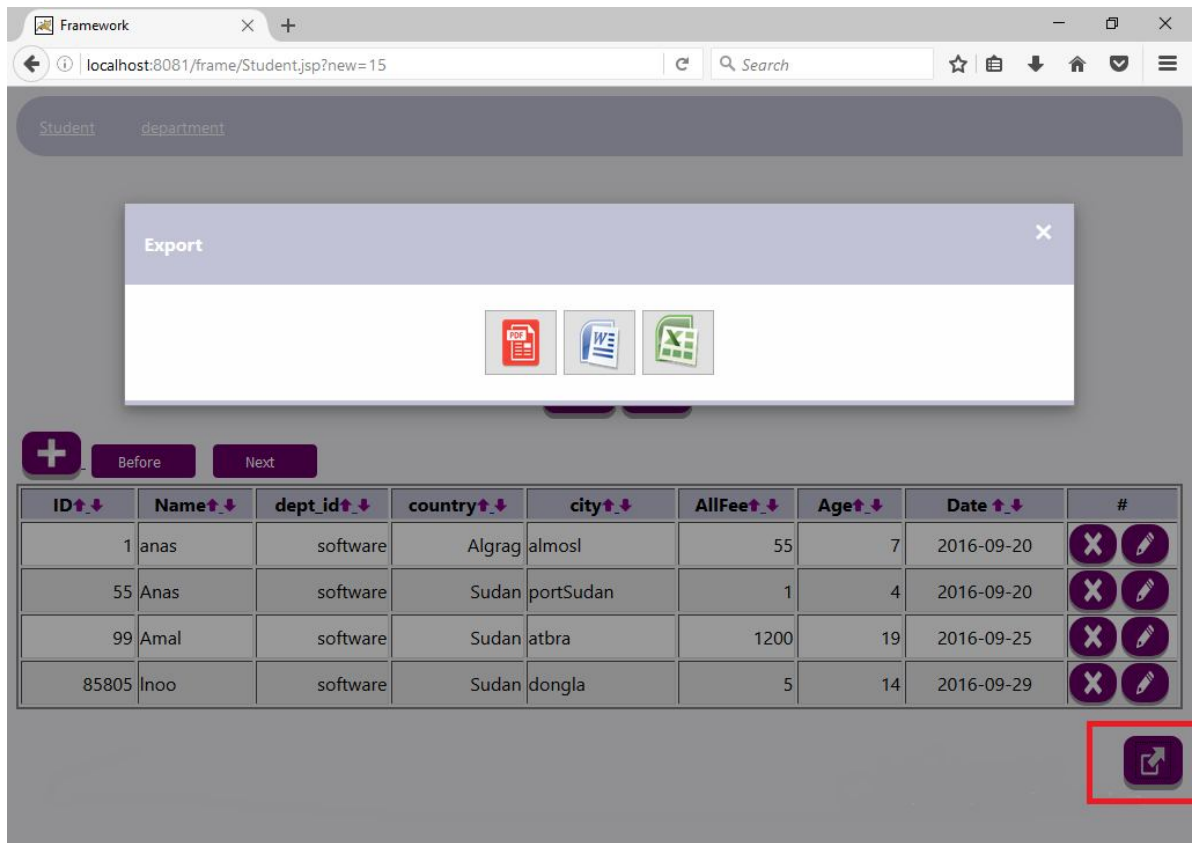
Figure 5.15 show "export component" created on the web page based on developer's commands.

CHAPTER SIX

Results, Recommendations

6.1 Introduction

This chapter shows the results achieved by using the web applications framework, the recommendations to extend the research functionality and also the conclusion.

6.2 Results

Develop web applications framework that contain the following components and features:

- ➢ Insert component.
- ➢ Update component.
- ➢ Delete component.
- ➢ Search Component
- ➢ Sort component.
- ➢ Export component.
- ➢ Pagination.
- ➢ Session management.
- ➢ Look up.
- ➢ Hot look up.
- ➢ Forms validation.
- ➢ Insert on grade.
- ➢ Update on grade.

After using the web applications framework on this research researchers reached the following results:

- ➢ Reduction in development time.
- ➢ Reduction in development efforts.
- ➢ Increase developer confidence.

> ➢ Develop web pages that meet the international standers of web pages' creation in some issues.

6.3 Recommendations

Due to time pressure, researchers were not able to complete the work on the framework development, those who will continue the research must take into their account the following recommendations:

> ➢ the developer must use the framework without need to write a codes just insert the basic query and select the components of the web pages using "drag and drop" technique or any other selection techniques.
>
> ➢ Take into account all other international standers of web page's creation, on this research we mention some of them not all, just to clarify that the research's framework represents a good ground for the application of international standers.

6.4 Conclusion

Because we are still students, we cannot say that our web application framework looks like ASP.NET or other frameworks and when we try to resolve some of their problems we didn't solve it perfectly because perfection isn't something humans can accomplish but we as developers did our best to provide all the features we could that is required in a software of this scale, but still there are huge work must be done to get brilliantframework this what we would like others who will complete what we started take care of it.

By using the research's web application framework, the process of web pages' creation become easier, faster and more efficient. The reason behind the research was to help the forgotten slot and they are the web developers.

We designed the system and analyzed it using UML (unified modeling language), and implemented it using Java, jQuery, JavaScript, CSS, HTML5, JSP, servlet, MySQL, JSON and number of java libraries.

We hope that those who will use our web framework get the best benefits from it, frameworks such as ASP.NET and other web frameworks performs good and sure they are better than our framework when we show there defects we didn't actually test them but we ask developers who use them. Sure, as we did with other's frameworks other developers will come and find defects on our framework.

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Appendixes

Appendix (A)
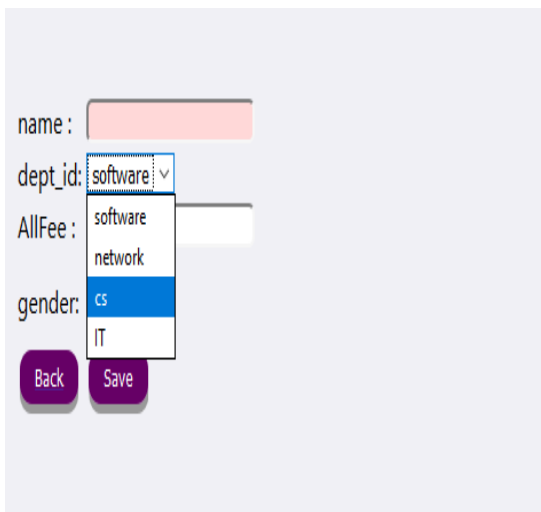
Web Application framework questionnaire

Introduction

To ensure that the developed web framework reduce time and efforts of developer the following questionnaire given for Sudan university master degree students.

Questionnaire

Tables and web page:

Base on the above table answer the questions:

1- To create insert form for web page that connected with database table you will take ….... minute.

  □1- 10   □10-20   □ 20-30   □ more □ less.

2- To create update form for web page that connected with database table you will take ….... minute.

  □1- 10   □10-20   □ 20-30   □ more □ less

3- To create search form for web page that connected with database table you will take ….... minute.

□1- 10   □10-20   □ 20-30   □ more □ less

4- To create code to delete data from database table you will take …... minute.
        □1- 10   □10-20   □ 20-30   □ more □ less

5- To create code to export data of database table you will take …... minute.
        □1- 10   □10-20   □ 20-30   □ more □ less

6- Type of sort you provide if you limited in one minute.
        □ASC   □DESC   □ both   □ not enough time

7- Type of export you provide if you limited in one minute.
        □PDF   □EXCEL   □ WORD   □ all □ not enough time

8- Is it easy for session management in sort component?
        □Yes   □No

9- To create code for pagination in web page that connected with database table
    you will take …... minute.
        □1- 10   □10-20   □ 20-30   □ more □ less.

10-To create look up in insert form for web page that connected with database
    table you will take …... minute.
        □1- 10   □10-20   □ 20-30   □ more □ less.

11-To create hot look up in insert form for web page that connected with database
    table you will take …... minute.
        □1- 10   □10-20   □ 20-30   □ more □ less.

12-To create insert on grade form for web page that connected with database table
    you will take …... minute.
        □1- 10   □10-20   □ 20-30   □ more □ less.

13-To create update on grade form for web page that connected with database
    table you will take …... minute.
        □1- 10   □10-20   □ 20-30   □ more □ less.

14-To test your web page test your web pages you will take …... minute.
        □1- 10   □10-20   □ 20-30   □ more □ less.

Appendix (B)

Business Process modeling Notation

Business process modeling

Graphics help facilitate the understanding of business deal between the organizations and it includes the companies themselves and the participants in it.
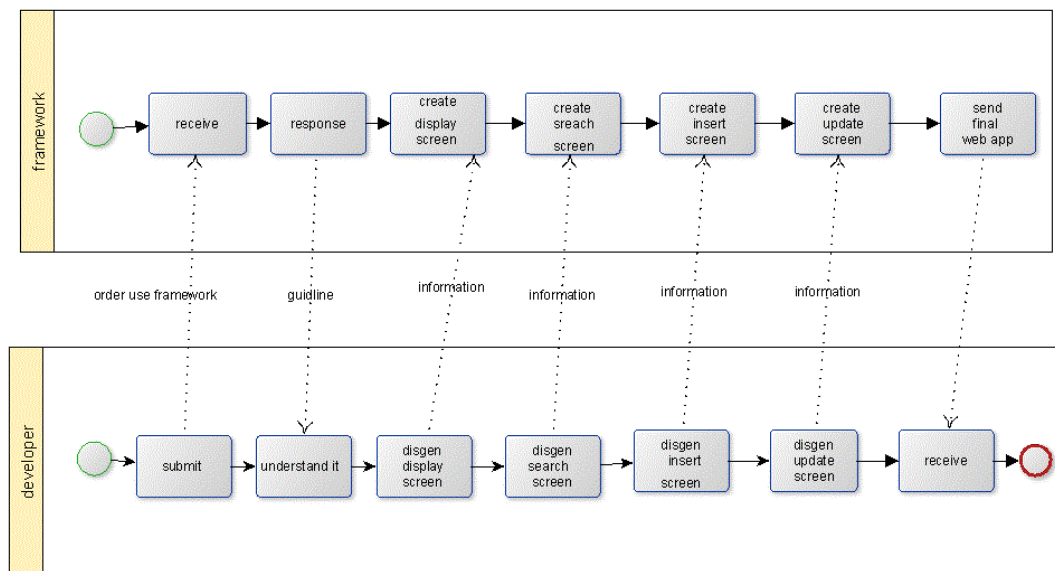

Diagram show business process model for research's framework

Appendix (C)

Framework Document

Framework's document

Steps to use web application framework:

- Developer need to download the framework folder from internet.
- Developer must create his own database for his application.
- Go to the class named DBconnect and on any connection in this class you must specify your database name to connect with it as following:
  connection=DriverManager.getConnection("jdbc: mysql://your server/database name","root","");
- For each web page developer, must create two files as following:
  - ➢ YourWebPageName.jsp: - this which appear on the web's browser.
  - ➢ YourWebPageNameSettings.java: - here developer specify the component he wants on YourWebPageName.jsp for example (display, insert, update, delete, search, sort, export, rename and also number of rows).

How to use the framework's components:
-

component	How to use it
display	Write the database query to select the data to be displayed as showing bellow: query="SELECT * FROM yourTableName";

update	Developer must add the column name to arraylist called updatecols as following:
	updatecols.add("columnName");
	and set "true" for variable called visableUpdate as following
	visableUpdate =true;

insert	Developer only need to add names of column that need to have an insertion form into arraylist called newCols as following: newCols.add("columnName"); and set "true" for variable called visableIns as following

	visableIns =true;
rename	To change the original database table's header name of the column and replace it with another name display in the web page developer must add to a linkedHashMap the original name and the new one as following: - rename.put ("old", "new");
search	To create search form developer must add the name of the columns he wants to make search by them in arraylist called searchCols as following: - searchCols.add("columnName");
sort	Framework provide developer by sort operation by default, if developer don't want sort buttons be shown on the top of the table he must delete the following line of code in HtmlManager.java: - • </button><a href='?new=5&colname="+ columnNames.get(i) + "&orderBy=DESC";
export	The Framework allow developer to export the data in three types word, pdf and excel and done by default and if developer don't want to show export button he must delete the following line of code from HtmlManager.java as following: - table+=getExport(columnNames, numRows, all1, numOfCols);
Must filled	For forms validation purpose framework allow developer to indicate the columns that must be filled by adding the column name in arraylist called mustFild as following: - mustFild.add("columnName");
delete	To be able to delete rows from data table, developer must set "true" for variable visableDelete as following: -

	visableDelete=true;
Number of rows	developer can select the number of rows that displayed per one page as following: - numRows = 4;
Look up	The Framework provide look up feature on forms, developer needs only to writethe name of column he wants look up on it and the database query that retrieve the look up data as following: - querylook.put("dept_id", "SELECT num ,name FROM department");