IMPLEMENTATION OF TAXONOMY APPROACH FOR SEARCHING LEARNING RESOURCE

By

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Dissertation submitted in partial fulfillment of
the requirements for the
Bachelor of Technology (Hons)
(Information Communication Technology)

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CERTIFICATION OF APPROVAL

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5036

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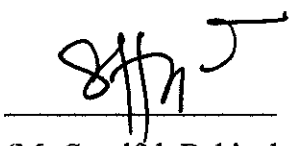
Approved by,

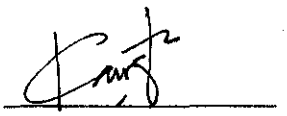


(Ms Syarifah Bahiyah Rahayu Syed Mansoor)

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein has not been undertaken or done by unspecified sources or persons.



(Mohamad Kamal Hanif Bin Shaari)

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

First of all, I would like to express my deepest gratitude to the Almighty Allah for the blessing and guidance for me to successfully complete the Final Year Project which consists the duration of two semesters.

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ABSTRACT

E-learning has become the common medium of sharing the content of lessons for learning purposes. Since the growth of e-learning usage has become wider, e-learning has evolved to be more complex and it combines lots of features to stimulate learning process. The purpose of this project is to implement the taxonomy based search for learning resources. Current searching method in e-learning only limits the searching to only one particular subject or element. Implementation of taxonomy based search will allow students to search through the site by using a single keyword. Search results then classified based on taxonomy tree developed. The system presents the search results differently depends on the nature of information of every category. To implement this project, Moodle is used as the e-learning model. The searching is based on Moodle database. Besides, summary of search results is provided in this system to represent search results in statistical data. The implementation of taxonomy approach for searching in Moodle is a better approach compared with the current searching approach. Taxonomy tree helps user to anticipate the search results for each nodes.

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CHAPTER 1
INTRODUCTION

1.1 Background of Study

Electronic Learning or commonly known as e-learning has become the medium of sharing the content of lessons for learning purposes. Nowadays, lots of e-learning system has been developed to cater the growth of e-learning usage. Previously, e-learning was developed to provide a mean for distance learning but now the usage of e-learning has widened not only for distance learning, but is also used in conjunction with face-to-face teaching. This approach is also known as blended learning in which e-learning system supplements the normal teaching methods [2].

Currently, most e-learning systems have integrated many components or technologies to stimulate learning process. The technologies that are being used in e-learning system are screen cast, discussion board, wiki, online assessment, blog, collaborative software, simulation and even electronic voting system [1]. These components are added to provide various options for learning resources in order to support the traditional face-to-face teaching. Examples of e-learning system are Moodle and Blackboard system. Moodle is used as e-learning model for this project. Moodle is an Open Source course management system (CMS) software package. It is designed using sound pedagogical principles, to help educators create effective online learning communities.

Since there are so many components being included, e-learning provides lots of potential learning resources to the students. For example, in Moodle itself, several features such as blog, forum, wiki, workshop and glossary are included. The features included in Moodle are excellent resources for students to assist them in learning process. Thus, e-learning system would be a significant source of learning resource for students instead of providing the communication channel between students and lecturers.

Currently, in the e-learning system specifically in Moodle, the system only limits the searching to only a particular element or subject instead of the whole site. This might limit the potential of e-learning in providing learning resources to the students. This project intends to provide a searching approach where students can search through the whole system with single keywords and search results are categorized in its own class to assists the students to anticipate the relevancy of search results.

1.2 Problem Statement

Since this project uses Moodle as e-learning environment model, this project focuses on the enhancements of searching feature available in the Moodle. Based on current system, Moodle provides different search pages for different entities in the system. Current system provides search pages for courses and forum. Thus, there is no searching approach that can search through the whole page and integrate the searching by using a single keyword. In brief, current searching approach only limits to only one particular element or subject instead.

Besides, current system limits the access to resources on a particular course to registered students of the course. This is the normal mechanism used to control the communication between students and lecturers. However, this limitation would discourage the potentials of e-learning as the provider of learning resources to both the registered and non-registered students. For example, glossaries on particular course which can be accessed by students who are registered under the courses might be useful to others students. However, since the access of resources limited to registered students only, the resources that can potentially benefit other students is not fully utilized.

Therefore, this project aims to provide a searching approach that could search the whole Moodle and categorize the search results based on corresponded class. Besides, this searching approach also aims to provide an alternative for students regardless of course registration status to access resources in the e-learning.

1.3 Objective and Scope of Study

The objective of this project is to implement the taxonomy based searching approach for learning resources. The project implements the taxonomy based search that is chosen from the study conducted. The searching approach developed is then integrated into Moodle. The objectives of this project are:

- To implement a search approach based on the taxonomy concept in the e-learning environment.
- To provide integrated searching approach for every key elements in e-learning environment.
- To categorize the searching results based on the Taxonomy tree.

The scope of study for this project is the search methods for learning resource. Since the objective of this project is to propose and implement the approach for search methods in learning resource specifically for e-learning environment, the focus of study emphasizes on study of the current approach and identifies the approach to integrate the taxonomy based searching in e-learning environment. The study also focuses on the approach proposed for taxonomy based search and how the approach could be used in e-learning environment.

The scope of this project is to integrate the identified approach in the UTP e-learning environment. Since UTP is now using the Moodle system, this project could help to users of the system to perform the search throughout the system.

1.4 Significant of the Project

This project helps the student to search the whole e-learning by using a single keyword. It is mainly being developed as a single independent module before being integrated with Moodle. In this approach, students are required to insert a single keyword and it will search through the whole Moodle and categorize the search results based on the classes. This helps students to anticipate the search results for every search results.

The search results are presented based on a taxonomy tree. This tree serves as the basis of this approach. The search results related to the keyword are categorized and it helps students to access the searching results easier. Students also could have anticipated searching results on every particular node on tree. For example, when students click on 'User' node, students must have expected to see list of users based on the searching keyword.

1.5 Relevancy of the Project

It is very relevant to implement the taxonomy searching approach in e-learning system since UTP itself has used Moodle as the e-learning system. E-learning has been frequently used by students and lecturers to share the contents of the course instead of excellent medium of communication. This project is an enhancement on the current e-learning and can be integrated as a new module in Moodle.

CHAPTER 2

LITERATURE REVIEW

The literature review of this project will focus on two main aspects which are e-learning and taxonomy-based searching methods. By conducting research on these two main aspects, it assists the author to proceed with the project.

2.1 E-learning System

Electronic learning or e-learning is a general term used to refer to computer-enhanced learning [1]. Besides of conventional e-learning term, it is also known as online learning or online education in which generally refer to purely web-based learning. In cases where mobile technologies are used, the term M-learning has become more common [1]. Initially, e-learning is commonly used for distance learning but now it has evolved to be used in conjunction with traditional face-to-face teaching method.

E-learning can be classified into four categories [4], from the very basic to the very advance. These four categories are:

- **Knowledge databases** -- While not necessarily seen as actual training, these databases are the most basic form of e-learning. This type offers indexed explanations and guidance for software questions, along with step-by-step instructions for performing specific tasks.
- **Online support** - Online support is also a form of e-learning and functions in a similar manner to knowledge databases. Online support comes in the form of forums, chat rooms, online bulletin boards, e-mail, or live instant-messaging support.
- **Asynchronous training** - This is e-learning in the more traditional sense of the word. It involves self-paced learning either CD-ROM-based, Network-based, Intranet-based or Internet-based. It may include access to instructors through online bulletin boards, online discussion groups and e-mail.

- **Synchronous training** - Synchronous training is done in real-time with a live instructor facilitating the training. Everyone logs in at a set time and can communicate directly with the instructor and with each other.

The most notable advantages of e-learning are flexibility, convenience and the ability to work at your own pace [1]. This makes an e-learning education a viable option for those that have other commitments such as family or work. Other advantages of e-learning is the ability to communicate with fellow classmates from around the country, a greater adaptability to learner's needs, more variety in learning experience with the use of multimedia and the non-verbal presentation of teaching material [1].

Other advantages of e-learning are:

- **Learning times reduced,** an average of 40 to 60 percent, as found by Brandon Hall (*Web-based Training Cookbook*, 1997, p. 108).
- **Increased retention** and application to the job averages an increase of 25 percent over traditional methods, according to an independent study by J.D. Fletcher (*Multimedia Review,* Spring 1991, pp.33-42).
- **Consistent delivery** of content is possible with asynchronous, self-paced e-learning [5].

The main disadvantage of e-learning system is the lack of interaction between students and teachers [1]. Other disadvantages of e-learning are:

- **Technology issues** of the learners are most commonly technophobia and unavailability of required technologies.
- **Portability** of training has become strength of e-learning with the proliferation of network linking points, notebook computers, PDAs, and mobile phones, but still does not rival that of printed workbooks or reference material.
- **Reduced** social and cultural interaction can be a drawback. The impersonality, suppression of communication mechanisms such as body language, and

elimination of peer-to-peer learning that are part of this potential disadvantage are lessening with advances in communications technologies [5].

It is being notable that e-learning apply the pedagogical approach to simulate learning process. Two of most common are those of instructional design and social-constructivist pedagogy [1]. In fact Moodle [6] applies the pedagogical approach. The stated philosophy of Moodle includes a constructivist and social constructionist approach to education, emphasizing that learners (and not just teachers) can contribute to the educational experience in many ways [7].

Other examples of e-learning system are:

- Free (ATutor, Bodington, Dokeos, KEWL, .LRN, LON-CAPA, Sakai Project) [6].

- Non-Free (Angel, Blackboard, Brightspark, Brihaspati, Desire2Learn, Edumate, FirstClass,WebCT) [6].

2.2 Taxonomy

Taxonomy is defined as the classification, or categorization, of things. For example, Web taxonomy would classify all the sites on the Web into a hierarchy for searching purposes. This comes from the Greek words "taxis" and "nomos," which mean "division" and "law" [8]. Originally the term taxonomy only referred to the science of classifying living organisms (now known as alpha taxonomy [10]); however, the term is now applied in a wider, more general sense and now may refer to a classification of things, as well as to the *principles* underlying such a classification [9].

In current usage within "Knowledge Management", taxonomies are seen as slightly less broad than ontologies [9]. Taxonomic classification is the act of placing an object or concept into a set or sets of categories (such as a taxonomy or a subject index), based on the properties of the object or concept [11]. Web-based taxonomy is the effort by taxonomists to use the World Wide Web in order to create unified, consensus taxonomies of life on Earth [13]. In his 2002 paper on the subject, H. Charles J. Godfray called for the creation of Web-based organisations to collect all the accumulated literature on a taxonomic group into a centralized knowledge base and make this data available through the Web as a unified taxonomy, so that it can be more easily examined and revised [12].

There are many attempts to classify the web content automatically into taxonomy [14, 15] [15]. The normal crawler-based search engines generally return results containing a lot of noise documents are the ambiguity of terms used in the user query. This ambiguity originates from the use of very short queries, which is usual in the web environment [16]. The taxonomy-based search engines can solve the search term ambiguity problem. It is because the searches can now be restricted to documents in the specified category. However, the searches can only be done against the manually compiled local databases, and cannot be expected to give many useful results [16].

According to Broder [17], web queries can be classified according to their intent into 3 classes which are:

1. Navigational: The immediate intent is to reach a particular site.
2. Informational: The intent is to acquire some information assumed to be present on one or more web pages.
3. Transactional: The intent is to perform some web-mediated activity.

Taxonomy based searching would provide better solution to arrive to the above characteristic of web queries. Ideally, the ontology-based approach is a promising way to solve some aspects of the precision problem, however it still requires two major pre-requisites. The prerequisite are that entire collection of Web pages must be transformed into ontological form and there is as yet no common agreement on the representation of the ontology, nor the query or reasoning mechanisms [18]. Even if these two prerequisites were satisfied, the precision problem in Web search would remain due to the huge amount of the information on the web [18].

CHAPTER 3
METHODOLOGY AND PROJECT WORK

3.1 Project Methodology

The methodology of conducting this project involves multi phase process. The first phase of the project is identifying the problem and defining the scope for this project. Besides, constrains for this project are also defined in this phase. The scope for this project is defined to focus on taxonomy-based searching method in e-learning system.

The next phase is where the research is conducted to gather information on taxonomy based search methods. This research focuses on several approach and frameworks identified in the earlier stage. Data gathered from the research are organized in a document which keeps track the results of the research. A study between search approaches available is made based on the data gathered.

From the study, the possible approaches for searching methods are listed for review and the suitable approach is chosen. The proposed approach is the foundation of works in later phase. Simultaneously, this project also required the study on the available e-learning frameworks. The purpose of study on the e-learning framework is done to identify suitable e-learning to implement the chosen taxonomy search framework. Process of redefine problems statements and constraints according to research is done before the enhancement is tested.

In the later phase, the proposed approach chosen is experimented to prove the efficiency of the taxonomy search engine in e-learning environment. This phase is the process of designing the software or system. The software or system developed is merely prototype to assess the implementation of the semantic search. System architecture and interface are designed in this phase.

Then, the designs are translated to a working prototype. The scope of this phase includes the development of the software or system and the testing of the developed software or system. The system is programmed using and then being integrated with the e-learning framework.

Finally, the taxonomy based search framework is evaluated by assessing the performance of the developed system in the e-learning environment. The output of search result is assessed and the performance is evaluated. The series of testing for targeted users are done in the evaluation process. The result of the evaluation concludes whether the taxonomy based search is really improving the quality of search result compared to results in the previous methods.

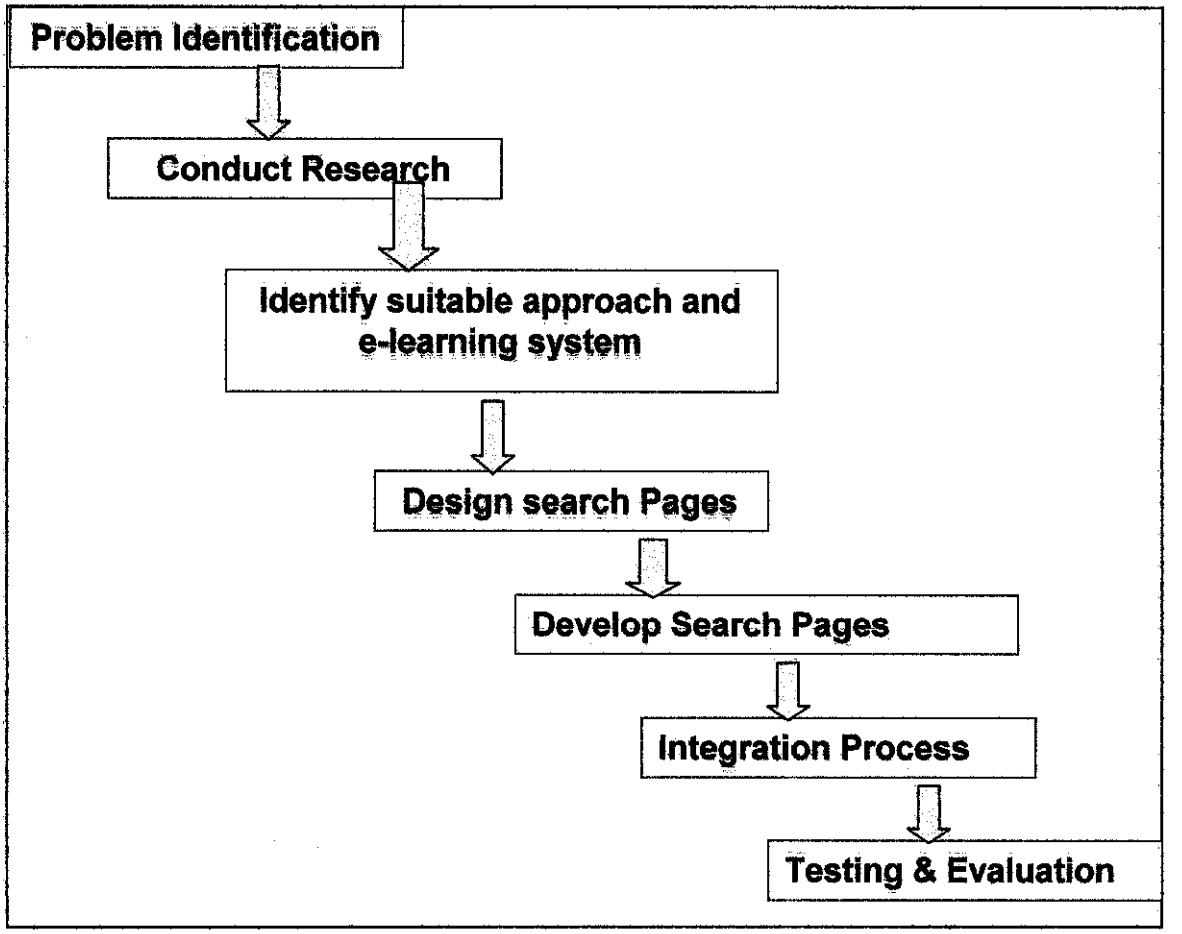


Figure 3.1: Project methodology for the system

3.1 Tool Used

Tools required to implement the project are listed below:

1) Software

- Moodle 1.6.3
- MySQL Database
- Apache Web Server
- PhpMyAdmin
- Macromedia Dreamweaver
- Microsoft FrontPage
- Microsoft Internet Explorer 6.0
- PHP Designer 2003

2) Hardware

- Standard desktop computer

3) Programming Language

- PHP
- JavaScript for client side scripting

CHAPTER 4

RESULT AND DISCUSSION

4.1 Problem Identification

The problem identification phase included the process of identifying the problem statement for this project. As stated in the problem statement above, the project is initiated on the basis that searching in current Moodle just limits the search to only for one particular subject or element.

4.2 Conduct Research

Research works for this project focuses on two main aspects which are on the e-learning system and also on the study of taxonomy. This research is primarily done to study and choose the suitable e-learning system and suitable approach of implementing taxonomy based searching for learning resources. The primary sources of the researches are through online resources, online database, written journal, conferences paper and also books.

4.3 Identify Suitable Approach and E-Learning System

This phase concerns with identifying the suitable searching approach and e-learning system. For this project, the chosen e-learning system is Moodle. The reasons of choosing Moodle as the e-learning system are:

- Moodle is available as a free open source e-learning system. This will eliminate the cost of purchasing the e-learning software for prototyping purpose.
- Moodle integrates several features such as blog, wiki, workshop, forum and online assessment in a single system. This is suitable for this project because the objective of this project itself is to provide searching approach for every key element in e-learning environment and categorize the results based on taxonomy tree.
- Moodle is currently being used as the e-learning system in UTP. This will make this project is more significant to the students.

The searching approach identified is by using taxonomy tree in categorizing the search results. The taxonomy based search frameworks enhance the capability of search engine by classifying the items based on its classes and assist user to anticipate the search result. A taxonomy tree is created based on the database schema and its relationship. The results are categorized in its own class to provide more relevant results. The taxonomy tree also functions as the navigational structure for users while browsing the results from the database. This approach is able to categorize the results based on its class set which could enhance the quality of searching in e-learning environment.

Taxonomy tree created in this project is fixed and subtracted from Moodle database. The reasons of fixing the taxonomy tree are:

- Moodle database consists of 153 tables. One entity might have more than one table. For example, 8 tables are used to store information on course. The tables are mdl_course, mdl_course_allowed_modules, mdl_course_categories, mdl_course_display, mdl_course_meta, mdl_course_modules, mdl_course_request, mdl_course_sections.
- There are difficulties to identify which table is useful if the taxonomy tree is generated dynamically.
- Fixing the nodes for Taxonomy tree ensure that only relevant nodes are included.

4.4 Design Search Pages

Design stage started when the approach for the system is already identified. This stage focuses on the interface design (what are the interfaces going to look like) and data design (what data will be required). Basically this project will use Moodle e-learning as the e-learning model.

In this stage, the user interface has been designed based on the Moodle system. Since this project takes Moodle system as the model, so the system's user interface is very much similar. This is very important to provide a consistent look while user browsing the system. Below is the design of user interface of the system.

A new section of searching tab is added in the Moodle system as displayed in Figure 4.1. This section is available for users to key in the keyword for the searching process. Then later the keyword is being used for searching throughout the database in the system. While users click on the search button, users will be redirected to another page which displays the searching results.

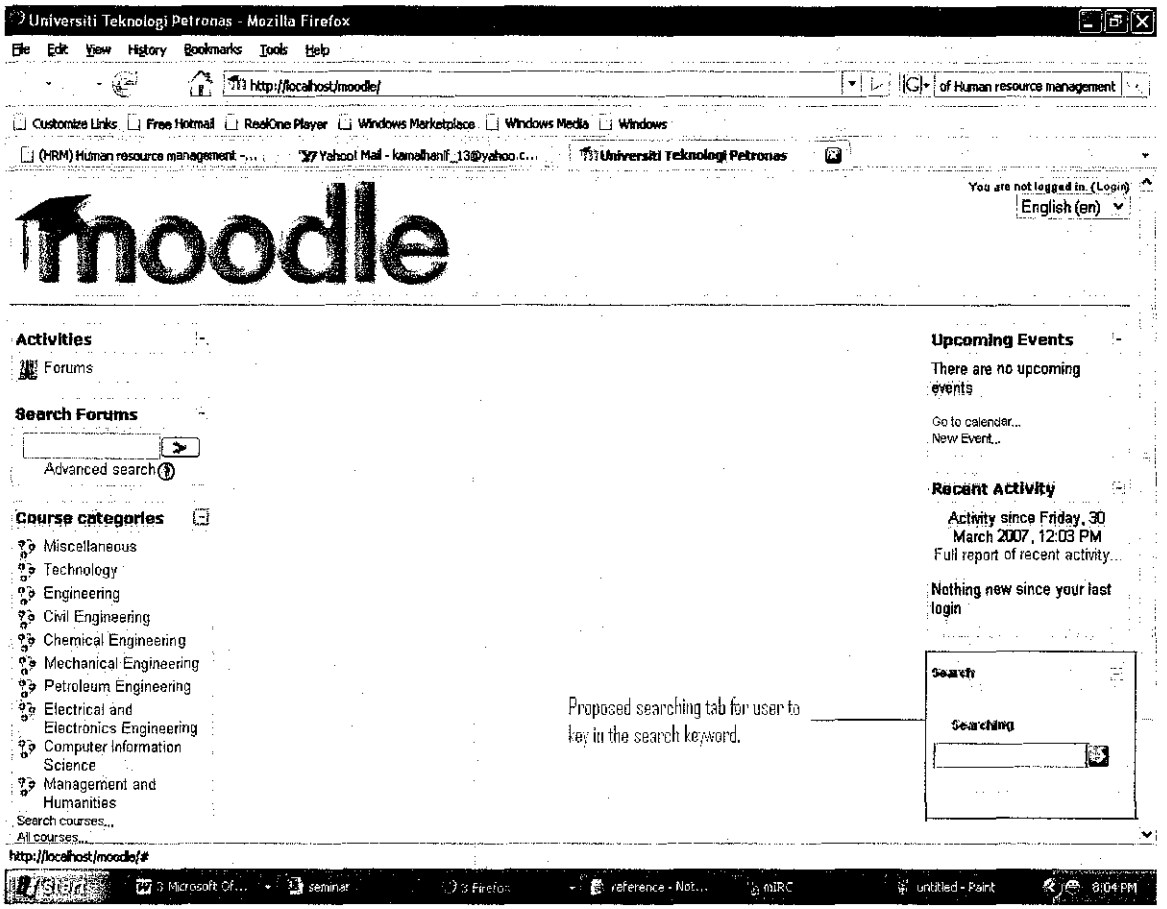


Figure 4.1: The searching tab for the system.

The searching page is divided into three frames which are top, left and right frame. The top frame includes the banner. Taxonomy tree is put on the left frame which is functioning as the navigational structure for searching results. Searching results is displayed on the right frame of the page. Figure 2 below demonstrate the division of frames in searching page.

Data for the searching is based on the Moodle database. There are 153 tables in the Moodle database. This project uses the database as the source of data for the searching results.

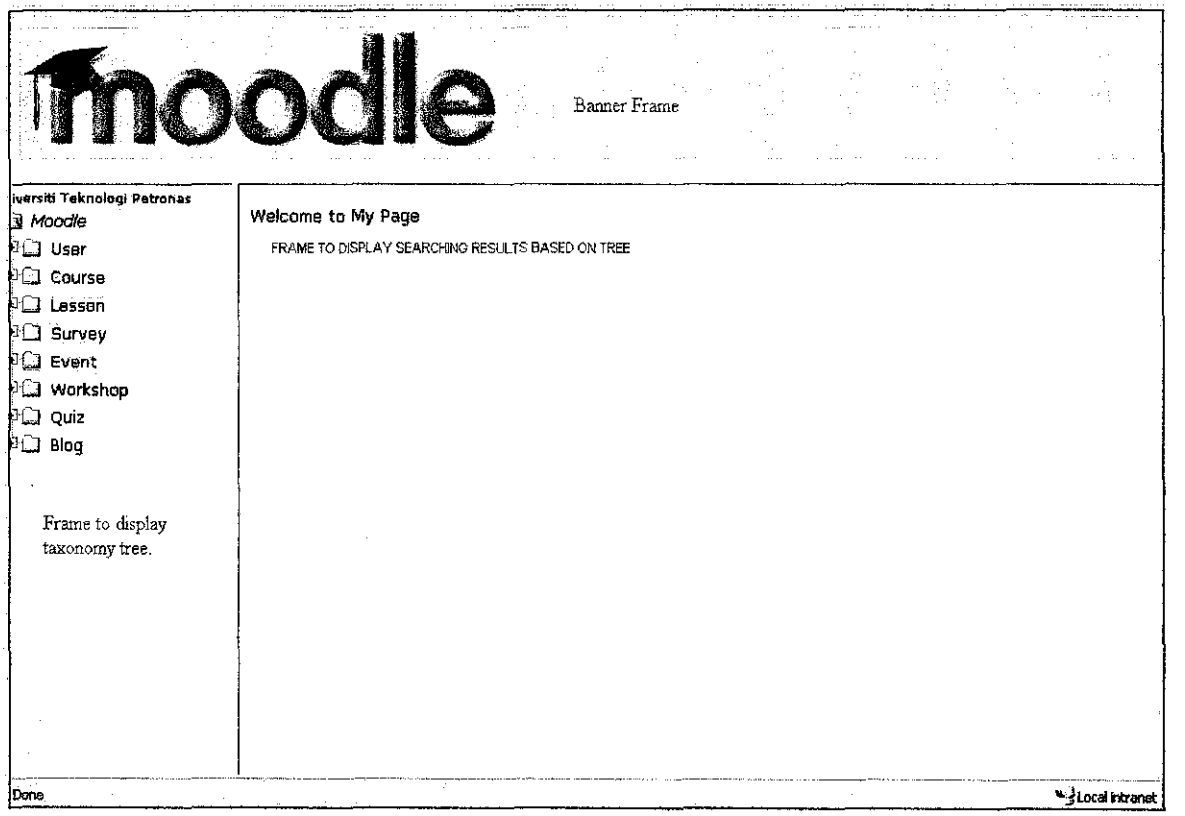


Figure 4.2: Division of frames in searching page.

Flowchart

The flowchart of how the approach works is presented in the diagram below:

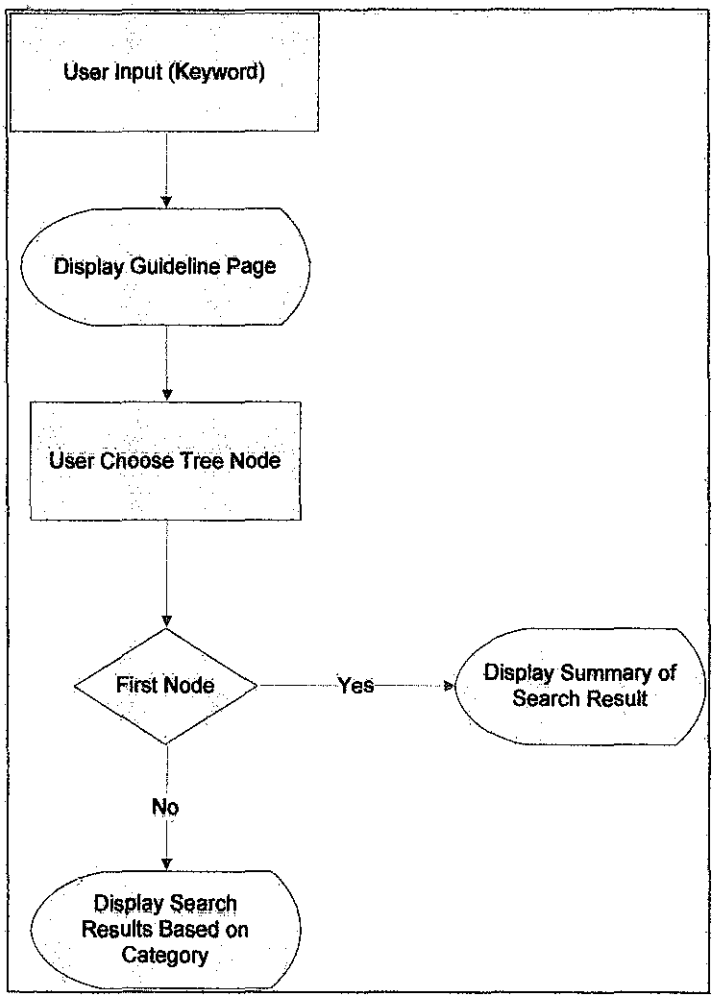


Figure 4.3: Flowchart of the searching approach.

Based on the above diagram, user needs to insert search keyword. User is redirected to a main page which displays the guidelines of using the system. Then, user is given option to click node on the taxonomy tree in the left frame of the page. If user clicks on the first node of each category, system displays the summary of search result for the category. Detail of search results is displayed if last node of every category is selected. Presentation of search results for each category is different based on the nature of information for the category.

Design the Taxonomy Tree

Taxonomy tree is the basis of the project. Choosing appropriate nodes to be included in the taxonomy tree is important to ensure that it is useful for users. In order to choose appropriate nodes for taxonomy tree, several criteria are considered. The criteria are:

- Main node of the category describes the major category of an entity in Moodle database. For example User and Course Category.
- Main node must be able to be expanded to smaller sub categories.
- The sub nodes must be related to the main node of its category.
- One node must not be redundant with other nodes in the same category.
- Level of categorization is limited to three levels. For example, User→Student→ICT/BIS.

The entity that fulfills the above criteria is selected as one of nodes for Taxonomy Tree. Table below describes the nodes in the taxonomy tree for this system.

Table of Nodes for Taxonomy Tree

First Node	Second Node	Last Node
User	Students	ICT/BIS
		Chemical
		Mechanical
		Civil
		Electric and Electronic
		Petroleum
	Lecturers	List of Lecturer
Course	Foundation	Engineering
		Technology
	Undergraduate	Computer Information Science

		Chemical
		Mechanical
		Civil
		Electric and Electronic
		Petroleum
		Management and Humanity
	Other Relevant Course	Listed by Lecturer Found
Event	Global	No node defined
	Course	
Resource	List of Resource	No node defined
Miscellaneous	Survey	No node defined
	Wiki	
	Workshop	
	Glossary	

Table 4.1: Table describes the nodes of taxonomy tree.

Design the Summary of Search Result Page

Summary of search result page is displayed when user clicks on first nodes of each category. This page provides the overview of search results for selected category. The goal of this feature is to provide statistical data of search results for users. This feature presents the summary of search results in two forms which are in a pie chart graph and in a table form.

Pie chart is automatically generated based on the number of search results for each category. The data of number of search results is sent to pie chart generator to generate correspond pie chart. Pie Chart generator process the data sent and generate a pie chart which is in PNG image format. The diagram below demonstrates the flowchart of how pie chart is generated:

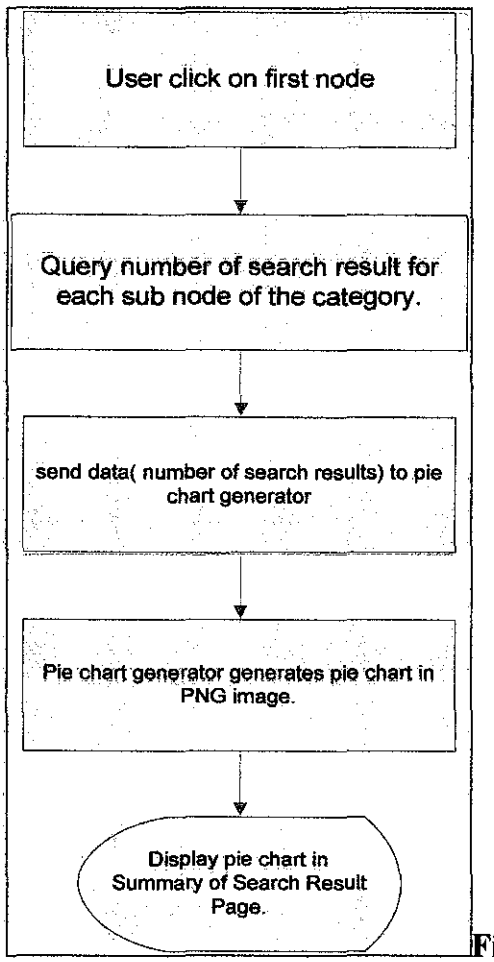


Figure 4.4: Flowchart of creating pie chart.

Below is the pseudo code for generating summary page for User Category. Generally, the similar steps are taken to generate summary for other categories.

```
//Pseudo Code for Generating Summary Page for User Category

Start
Query all results match with keyword in 'User Table'
Declare variables for each department // Variable for array name. Initialized to value 0
For loop
{
If second char is not a digit
Plus 1 to $lecturer array
Else if first char is 'I'
Plus 1 to $itis array
Else if first char is 'M'
Plus 1 to $mechi array
Else if first char is 'E'
Plus 1 to $ee array
Else if first char is 'K'
Plus 1 to $chemi array
Else if first char is 'C'
Plus 1 to $civil array
Else if first char is 'P'
Plus 1 to $petroleum array
End Else If
}
end loop

//get value for $student variable
$student = $itis + $chemi+ $mechi + $ee + $petroleum + $civil

//Display Summary Page
If no result found
Inform user that no summary generated
Else
Display pie chart 'Portion of Students and Lecturers Based on Search Results'
//send $lecturer and $student parameter to generate pie chart.

Display pie chart 'Classification of Students Found Based on '
//send number of result for every department array ($itis, $chemi, $civil, $mechi,
$petroleum, $ee) parameter in to generate pie chart.
End if else
Display the result in table form
// Construct 2 table column and list number of results for every department.
End
```

Table 4.2: Pseudo code for summary of search result for user category

Design the Search Results Pages

The design of page to display the information for one category is different from one another. The presentation of the search results is based on the nature of information for each category. Table below describes the information that is expected for each category.

Category	Search Result's Information
User	▪ Name ▪ Email address ▪ Location
Course	▪ Course name ▪ Course summary ▪ Lecturer name
	For Other Relevant Course ▪ Lecturer name found based on keyword. ▪ Course(s) taught by the lecturer
Event	▪ Event name ▪ Event description ▪ Course Name (under course event category)
Resource	▪ Resource name ▪ Downloadable file * Provide list of course(s) found based on search keyword in drop down box. Allow user to view resources related to selected course.
Miscellaneous	▪ Item name ▪ Description/summary of item found

Table 4.3: Search result information for every category.

Table 4.4 below shows the example of pseudo code for displaying the search result according to every department under user category.

```
//Pseudo Code for displaying result for student category
Start
Query all results match with keyword in 'User Table'
Declare variables for each department // Variable for array name. Initialized to value 0
For loop (smaller than number of records)
{
Else if first char is 'I'
Insert id record to $itis array
Else if first char is 'M'
Insert id record to $mechi array
Else if first char is 'E'
Insert id record to $ee array
Else if first char is 'K'
Insert id record to $chemi array
Else if first char is 'C'
Insert id record to $civil array
Else if first char is 'P'
Insert id record to $petroleum array
End Else If
}
End Loop

Get program name from URL

If program is 'itis'
Set value for $max to number of record in $itis array
Else if program 'chemi'
Set value for $max to number of record in $chemi array
Else if program 'mechi'
Set value for $max to number of record in $mechi array
Else if program 'petroleum'
Set value for $max to number of record in $petroleum array
Else if program 'civil'
Set value for $max to number of record in $civil array
Else if program 'ee'
Set value for $max to number of record in $ee array

//display the table.
Display the heading of table

For loop (smaller than $max variable)
{
```

```
If program is 'itis'
Query details of students based on record in $itis array
Else if program is 'chemi'
Query details of students based on record in $chemi array
Else if program is 'mechi'
Query details of students based on record in $mechi array
Else if program is 'civil'
Query details of students based on record in $civil array
Else if program is 'ee'
Query details of students based on record in $ee array
Else if program is 'petroleum'
Query details of students based on record in $petroleum array

Get the details of each student
Display the details in table
}
End Loop
End program
```

Table 4.4: Pseudo code for displaying search results according to department under user category.

4.5 Develop Search Pages

Based on the approach identified, the progress of the development process has started based on the project scope and methodology that has been discussed above. Since the suitable approach has been selected for the system, the next phase focuses on the system design and development.

Pre-Development Process

Before proceed with the coding and system development process, several process has been taken place. The first process is to install the web server and database server for development purpose. Since Moodle is used as the model for this project, so this system also uses PHP as the scripting language.

In order to use the services, WAMP server has been installed to provide the required services. This service will install PHP 5, MySQL 5, Apache 2, phpmyadmin and also SQLiteManager.

The next process is to install Moodle system which is also an open source e-learning system. The Moodle system is installed for the purpose of prototype development process.

System Development

The development of the system focuses on the development of the taxonomy tree itself and the development of the pages to display search results in the system. The main concept of categorizing the searching results based on the classes is to help the users to anticipate the results for every particular class. User might expect list of Courses displayed if the users click on the course nodes on the tree. This will certainly enhance the quality of searching in Moodle.

Taxonomy tree is the basis of the development of the system. This tree is developed using JavaScript as it needs to be expanded or collapsed in the web browser without refreshing. Taxonomy tree is created based on the key element in the Moodle database. Figure below demonstrates the taxonomy tree developed for this project.

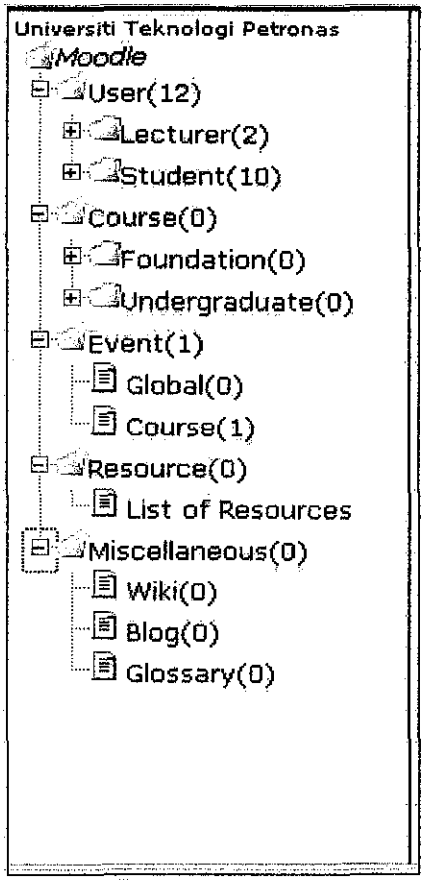


Figure 4.5: Taxonomy tree of the system.

When user first redirected to the searching page from search keyword form, user will be displayed with a page displays the number search results for every category as in Figure 4.6.

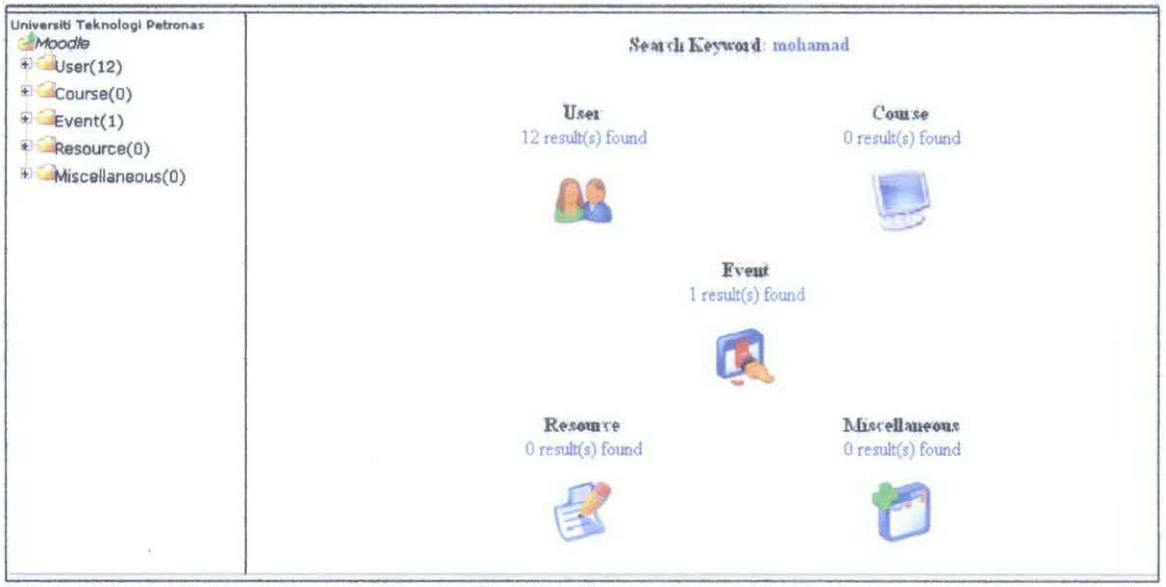


Figure 4.6: Display the main page for viewing search results.

This system also provides the summary of search results when user clicks on the first node of the tree (User, Course, Event, Resource, and Miscellaneous). This page presents the summary of search results in graphical pie chart and in table form.

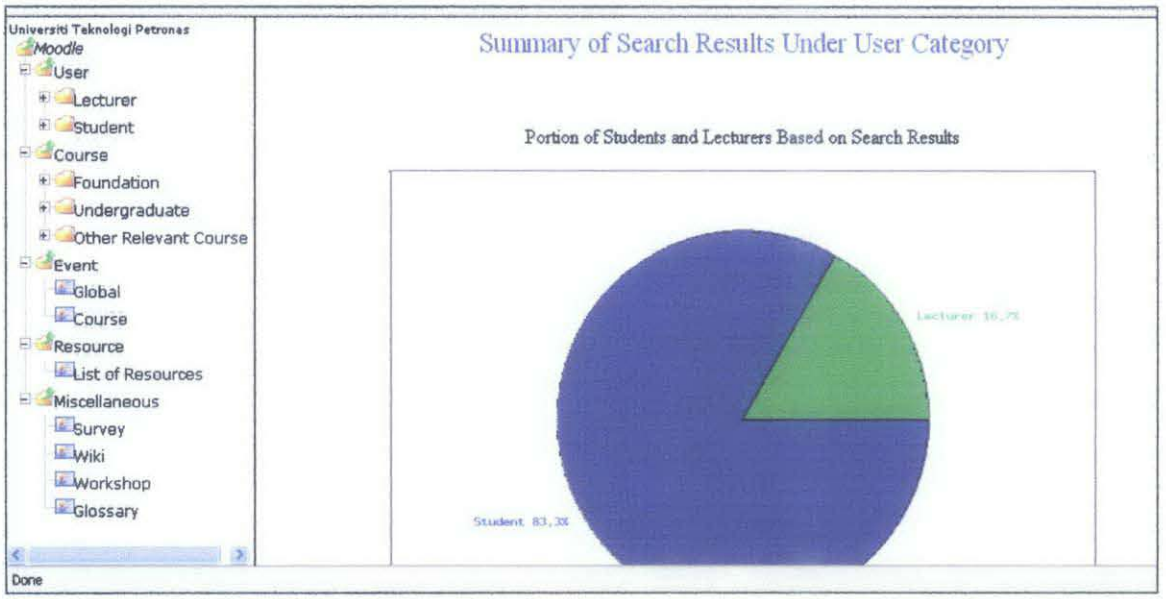


Figure 4.7: Display the summary of search results under user category.

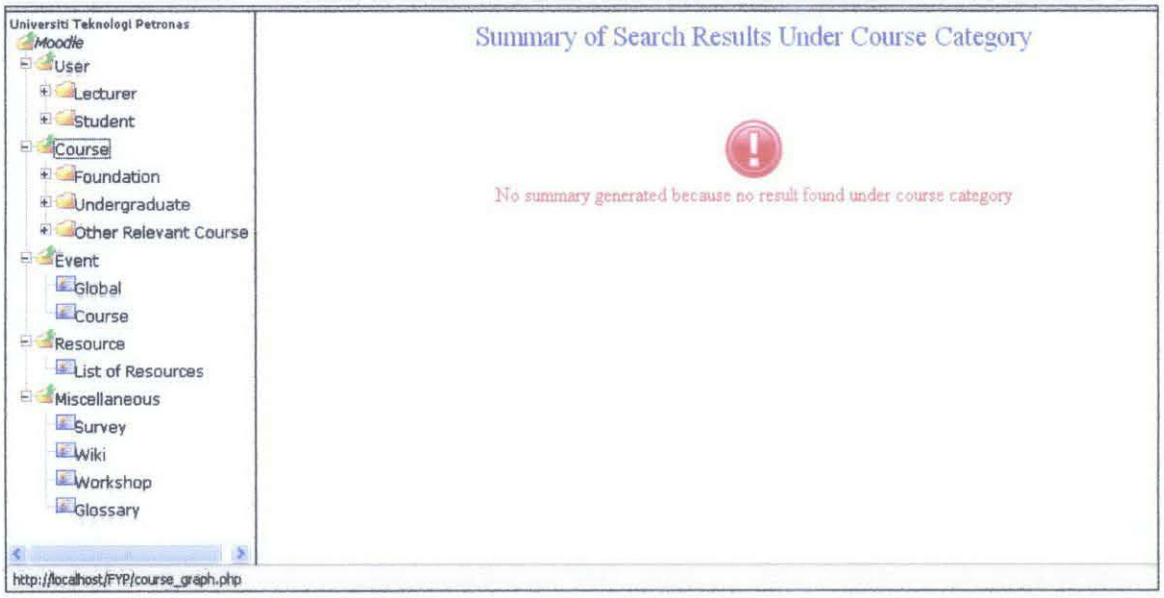


Figure 4.8: No summary of search result generated if no results found under the selected category.

The search results of each category are displayed while user clicks on the last node of the taxonomy tree. The presentation of each category different from another category depends on the nature of information under each category.

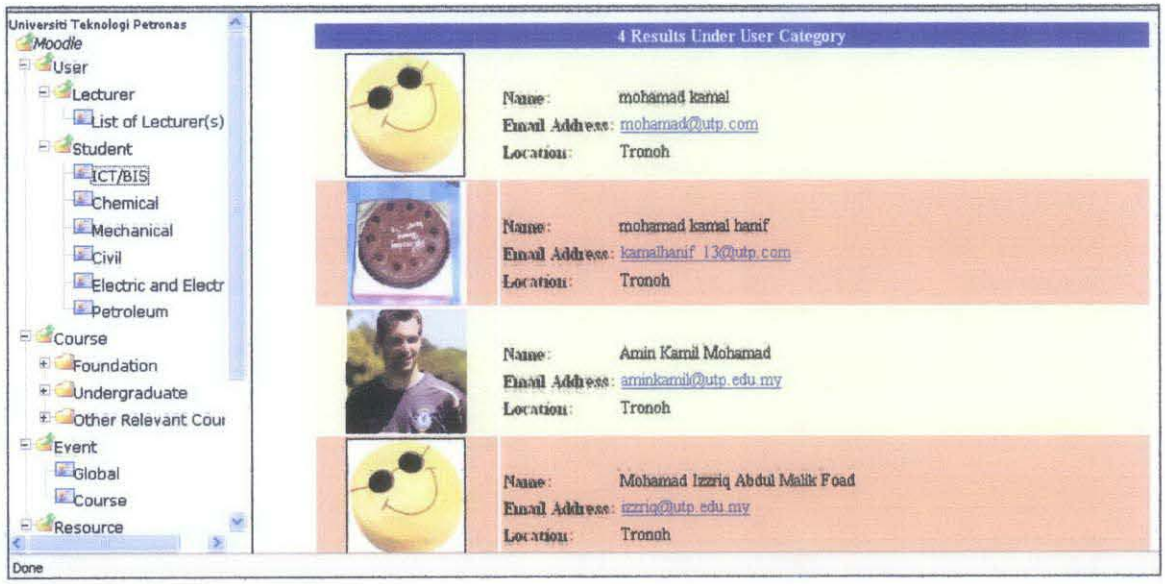


Figure 4.9: Page displays the search results under user category.

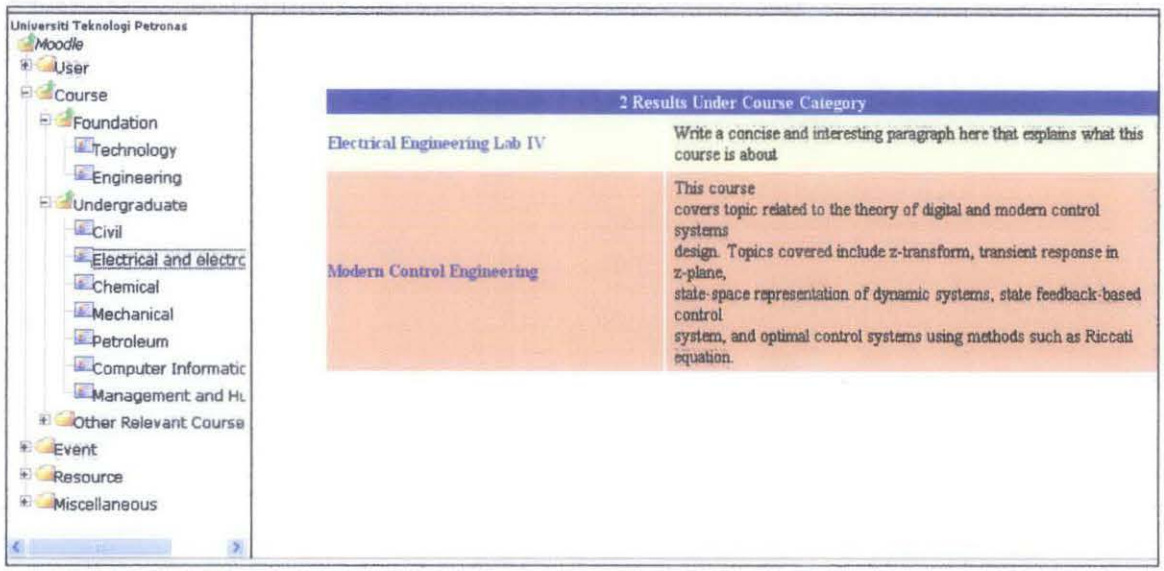


Figure 4.10: Display the search results under course category.

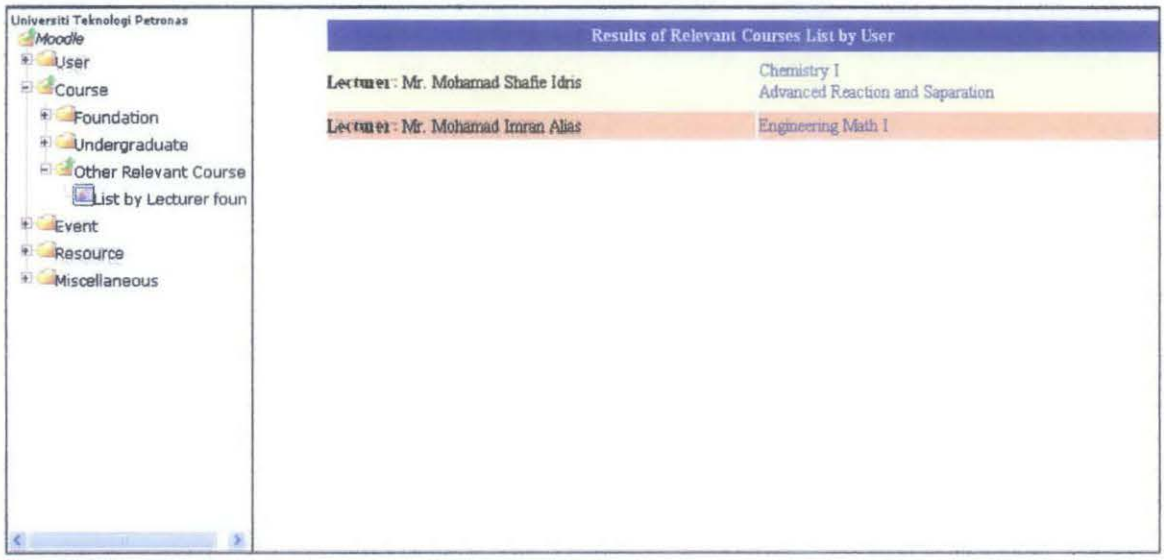


Figure 4.11: Page displays the results of other relevance course listed by lecturers found.

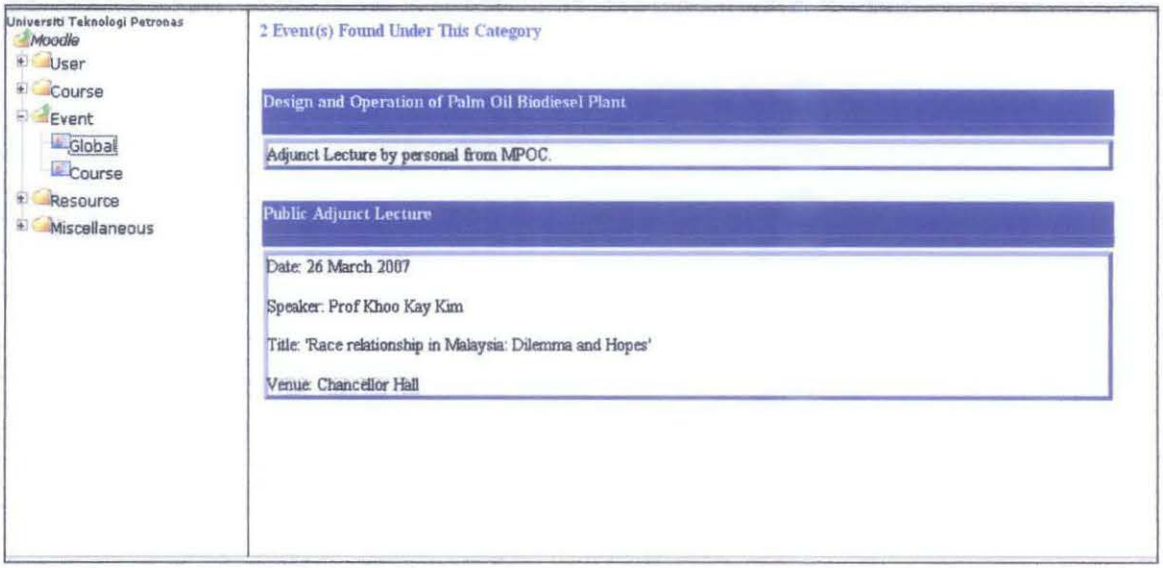


Figure 4.12: Page displays the results under event category.

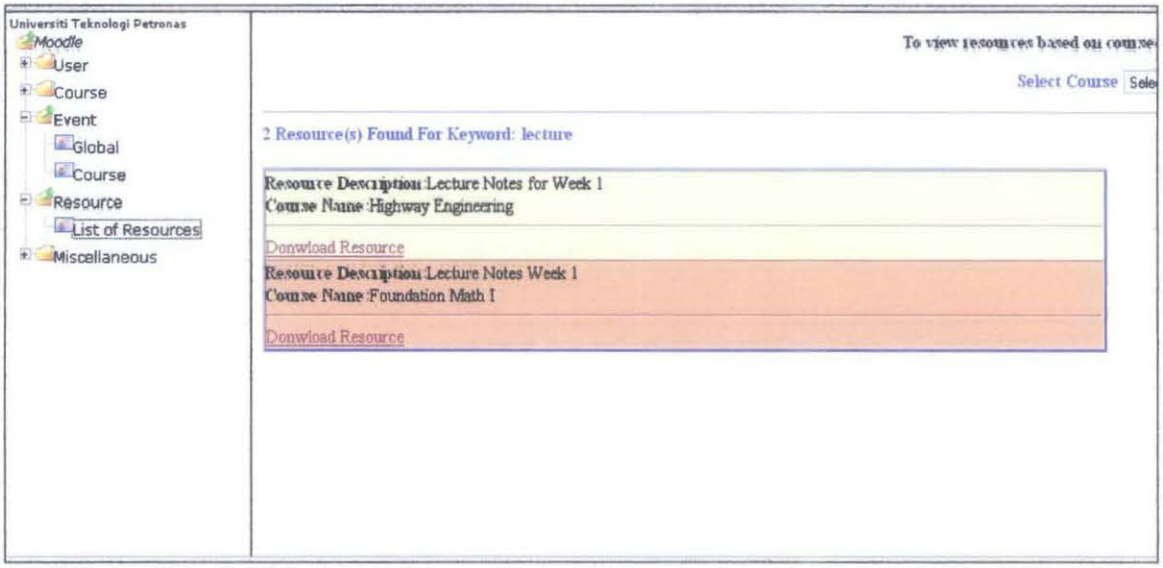


Figure 4.13: Page displays the results under resource category.

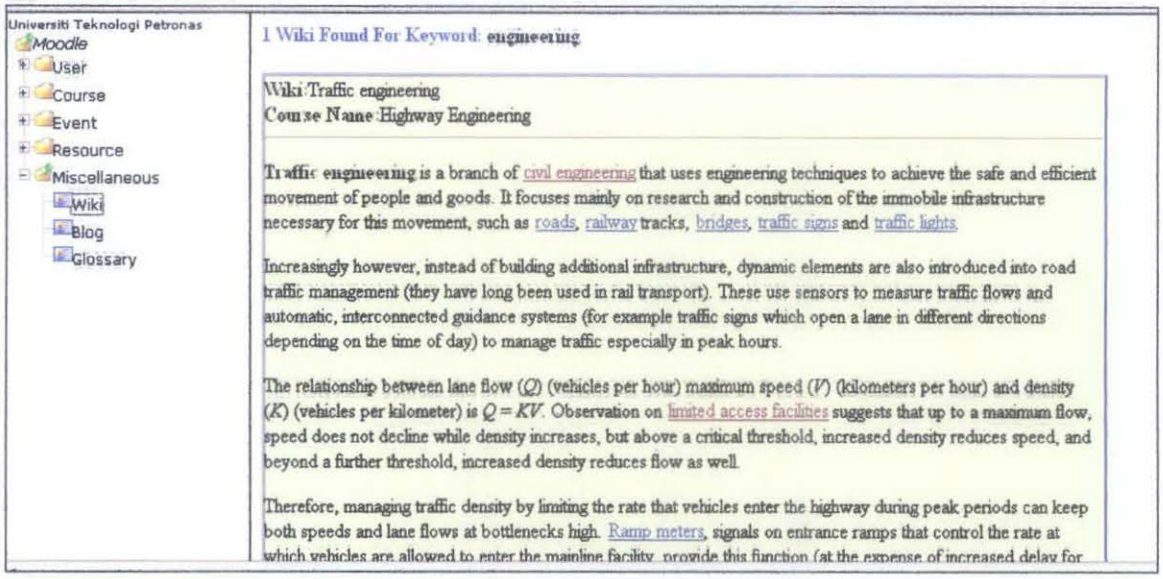


Figure 4.14: Page displays the result under wiki category.

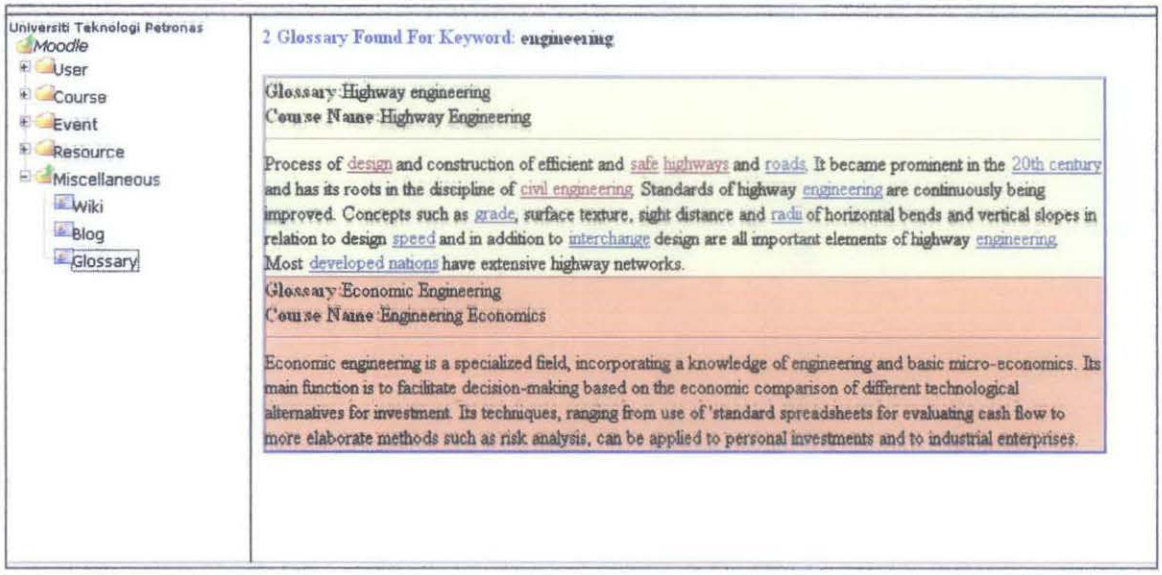


Figure 4.15: Page displays the results under glossary category.

4.6 Integration Process

Integration process is performed after the development of search pages is completed. Since Moodle is developed on the module based, this feature is added as one of modules in current Moodle. The files developed are gathered in one folder named 'taxonomy' folder. The folder is then copied into Moodle folder in web server. The searching tab is added in Moodle main page as designed in Figure 1 above.

4.7 Testing and Evaluation

Testing is conducted after the module is completely developed and integrated. In this project, two types of testing is conducted which are functional test and user acceptance test. Functional test is conducted by the author while user acceptance test involved the students who are the actual users of Moodle.

Functional Testing

Functionality test is conducted to detect and debug any flaws on the system. It is necessary to ensure that the system is able to perform its functionality as expected. The test results of testing conducted described in table below.

No	Function	Action Perform	Expected Test Result	Actual Test Result
1	Submit search keyword	▪ Insert search keyword in search from.	▪ User will be notified if text field is not filled.	▪ Successfully notified if no keyword inserted.
			▪ User is redirected to main page of search page. Display guidelines of using the search page.	▪ Successfully redirect user to main page of search result.
2	Display summary of search result for 'User' category.	▪ User click on 'User' node. Valid Input 'Mohamad' Invalid Input 'Kashif'	▪ Display the summary page if any result found from the keyword.	▪ Successfully display the summary page.
			▪ Notify user if no result is found under 'User' Category.	▪ Successfully notify user that no summary generated because no result is found.
3	Display details of search results under 'User' category.	▪ User click on last node under 'User' Category. Valid keyword 'Mohamad' Invalid keyword 'Kashif'	▪ Display the list of user found for specific category.	▪ Successfully display the list of users under 'User' category.
			▪ Notify user if no result is found under specific node selected.	▪ Successfully notify user that no result is found.
4	Display summary of search result for 'Course'	▪ User click on 'Course' node. Valid Input	▪ Display the summary page if any result found	▪ Successfully display the summary page.

	category.	'Engineering' Invalid Input 'Mohamad'	from the keyword.	
			▪ Notify user if no result is found under 'Course' Category.	▪ Successfully notify user that no summary generated because no result is found.
5	Display details of search results under 'Course' category.	▪ User click on last node under 'Course' Category. Valid keyword 'Engineering' Invalid keyword 'Mohamad'	▪ Display the list of user found for specific category.	▪ Successfully display the list of users under 'course' category.
			▪ Notify user if no result is found under specific node selected.	▪ Successfully notify user that no result is found.
			▪ List the lecturer name and course taught for any lecturer found with keyword 'Mohamad'	▪ Successfully list the name of lecturer found and course(s) taught by the lecturer found based on keyword 'Mohamad'.
6	Display summary of search result for 'Event' category.	▪ User click on 'Event' node. Valid Input 'Lecture' Invalid Input 'Kashif'	▪ Display the summary page if any result found from the keyword.	▪ Successfully display the summary page.
			▪ Notify user if no result is found under 'Event' Category.	▪ Successfully notify user that no summary generated because no result is found.

7	Display details of search results under 'Event' category.	▪ User click on last node under 'User' Category. Valid keyword 'Lecture' Invalid keyword 'Kashif'	▪ Display the list of event found for specific category.	▪ Successfully display the list of events under 'Event' category.
			▪ Notify user if no result is found under specific node selected.	▪ Successfully notify user that no result is found.
8	Display details of search results under 'Event' category.	▪ User click on last node under 'Resource' Category. Valid keyword 'Lecture' Invalid keyword 'Kashif'	▪ Display the list of resources found for search keyword	▪ Successfully display the list of resources for search keyword. Provide link to download the resources.
			▪ Notify user if no result is found for search keyword.	▪ Successfully notify user that no result is found.

Table 4.5: List of test results conducted for the project.

User Acceptance Testing

User acceptance testing involved real users of this system who are the students. For this project, the acceptance testing involved 15 students. Students are given the scenario to use the system. Then student's behavior is observed to examine whether the system is user friendly or not.

Overall, all students has agreed that the project has achieved the objectives and solved the problem statement. 12 out of 15 students satisfied with searching approach developed for this project. 13 students agreed that the project is completed. Generally, all students

agreed that the system is easy to navigate. Besides, students also agree that user interface for this system is met satisfaction.

From the user testing, several comment and suggestion from user are noted. The students suggest that the searching would provide the results of books or documents found from UTP library system. This would provide alternative for them instead of need to find from OPAC system itself.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

As the conclusion, this project focuses on the development of the taxonomy based searching in Moodle. Since one of the objectives of the project is to classify the searching results based on its category, taxonomy based searching has been developed to accomplished the objective. The basis of this project primarily relies on the taxonomy tree. The taxonomy tree developed demonstrates the classification of data based on several categories defined in Moodle.

The development of taxonomy based search in Moodle helps the students to search the whole system by just using a single keyword. Search results then presented based on the categories defined in taxonomy tree. This approach helps students to anticipate the search results for every category. Taxonomy tree also acts as the navigational structure while students browsing search results. Besides, this system also provides the summary of search results for each category.

Taxonomy approach for searching in learning resources helps user to anticipate search results for every category. Taxonomy tree developed classifies the search results based on its category. Besides, this approach also provides a mechanism for non-registered student for particular course to search for resources that might be useful for them.

5.2 Recommendation

To enhance the features of the system, several enhancements are identified as future work for this project. Proposed enhancements are listed below:

- *Develop a generic taxonomy approach for searching learning resource*
  This project is only focusing on implementation of taxonomy approach in Moodle only. This approach can be implemented in other e-learning system as well. For future enhancements, a generic approach can be developed where it can be integrate with other e-learning systems.

- *Add search agent to aggregate the content from online database and e-resources*
  Online database or e-resource is excellent sources for student to search for latest journals or work papers. Examples of e-resources currently available are ACM Digital Library, IEEE/IEE Electronic Library, IT KnowledgeBASE, Springer LINK, Science Direct and SPE e-Library. Search agent can be created to search information from online databases and e-resources and search results are classified in taxonomy tree.

11) Wikipedia Free Encyclopedia. Taxonomy Classification. Retrieved January 18th, 2007, from http://en.wikipedia.org/wiki/Taxonomic_classification

12) Godfray, H.C.J (2002). Challenges for taxonomy. Nature 417: 17-19

13) Wikipedia Free Encyclopedia. Web Taxonomy. Retrieved January 18th, 2007, from http://en.wikipedia.org/wiki/Web_Taxonomy

14) C. Apte et al. Towards language independent automated learning of text categorization models. In SIGIR Conference on Research and Development in Information Retrieval, pages 23–30, 1994.

15) S. Chakrabarti et al. Scalable feature selection, classification and signature generation for organizing large text databases into hierarchical topic taxonomies. The VLDB journal,7(3):163–178, 1998.

16) S. M. Pahlevi, H. Kitagawa, "Taxonomy-based adaptive web search method", University of Tsukuba, 2002.

17) A. Broder, "A taxonomy of web search", IBM, 2002.

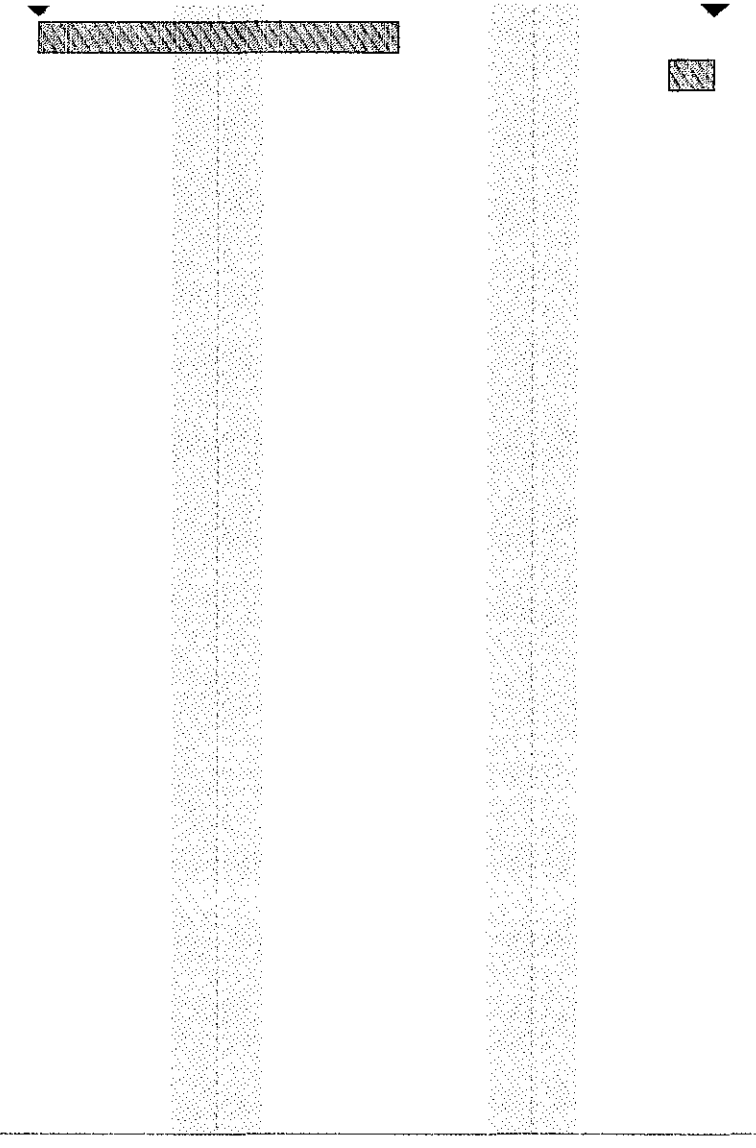
18) L. Kerschberg, W. Kim, and A. Scime, "A Personalizable Agent for Semantic Taxonomy-Based Web Search ", George Mason University, 2003.

APPENDIX

APPENDIX A

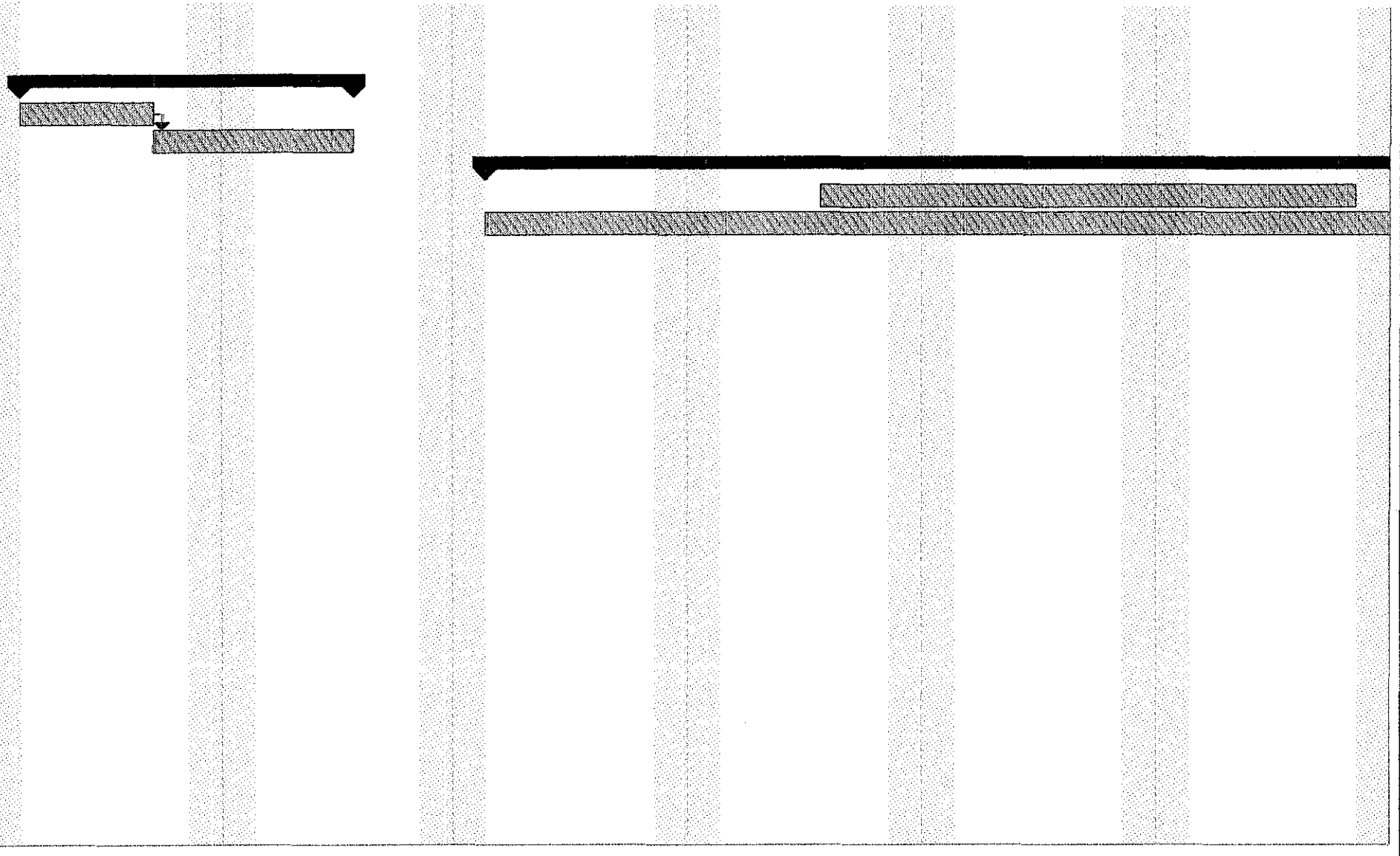
PROJECT GANTT CHART

2		1.1 Propose Topic	6 days	Wed 7/26/06	Wed 8/2/06
3		1.2 Topic assigned to student	1 day	Wed 8/9/06	Wed 8/9/06
4		**2. Problem Definition**	**8 days**	**Mon 8/14/06**	**Wed 8/23/06**
5		2.1 Identifying problem statement for pr	4 days	Mon 8/14/06	Thu 8/17/06
6		2.2 Defining the scope and constrains f	4 days	Fri 8/18/06	Wed 8/23/06
7		**3. Conduct Research**	**21 days**	**Mon 8/28/06**	**Mon 9/25/06**
8		3.1 Studying the available e-learning sy	12 days	Thu 9/7/06	Fri 9/22/06
9		3.2 Research on Taxonomy Methods	21 days	Mon 8/28/06	Mon 9/25/06
10		**4. Identify Approach and E-learning Syste**	**12 days?**	**Thu 9/28/06**	**Fri 10/13/06**
11		4.1 Identify E-Learning System	6 days?	Thu 9/28/06	Thu 10/5/06
12		4.2 Identify Approach	6 days?	Fri 10/6/06	Fri 10/13/06
13		**4. Design**	**33 days**	**Thu 10/19/06**	**Mon 12/4/06**
14		4.1 Design System Flow	7 days	Thu 10/19/06	Fri 10/27/06
15		4.2 Design taxonomy Tree	6 days	Mon 10/30/06	Mon 11/6/06
16		4.3 Design Summary Page	10 days	Tue 11/7/06	Mon 11/20/06
17		4.4 Design search results page for ever	10 days	Tue 11/21/06	Mon 12/4/06
18		**5. Development**	**50 days**	**Wed 12/20/06**	**Tue 2/27/07**
19		5.1 Develop taxonomy tree	10 days	Wed 12/20/06	Tue 1/2/07
20		5.2 Develop summary page	20 days	Wed 1/3/07	Tue 1/30/07
21		5.3 Develop searching pages for each c	20 days	Wed 1/31/07	Tue 2/27/07
22		**6. Integration**	**10 days**	**Thu 3/1/07**	**Wed 3/14/07**
23		6.1 Integrate the develop page with Moc	10 days	Thu 3/1/07	Wed 3/14/07
24		**7. Testing and Evaluation**	**13 days**	**Mon 3/19/07**	**Wed 4/4/07**
25		7.1 Conduct functionality test	5 days	Mon 3/19/07	Fri 3/23/07
26		7.2 Conduct integration test	3 days	Mon 3/26/07	Wed 3/28/07
27		7.3 Conduct user acceptance test	3 days	Mon 4/2/07	Wed 4/4/07
28		**7 FYP Part A Research Evaluation**	**4 days**	**Fri 4/6/07**	**Wed 4/11/07**
29		**8 Seminar**	**5 days**	**Fri 4/6/07**	**Thu 4/12/07**
30		**9 Pre-EDX**	**1 day**	**Fri 4/6/07**	**Fri 4/6/07**
31		**10 Oral Presentation (External Examiners**	**2 days**	**Mon 4/23/07**	**Tue 4/24/07**



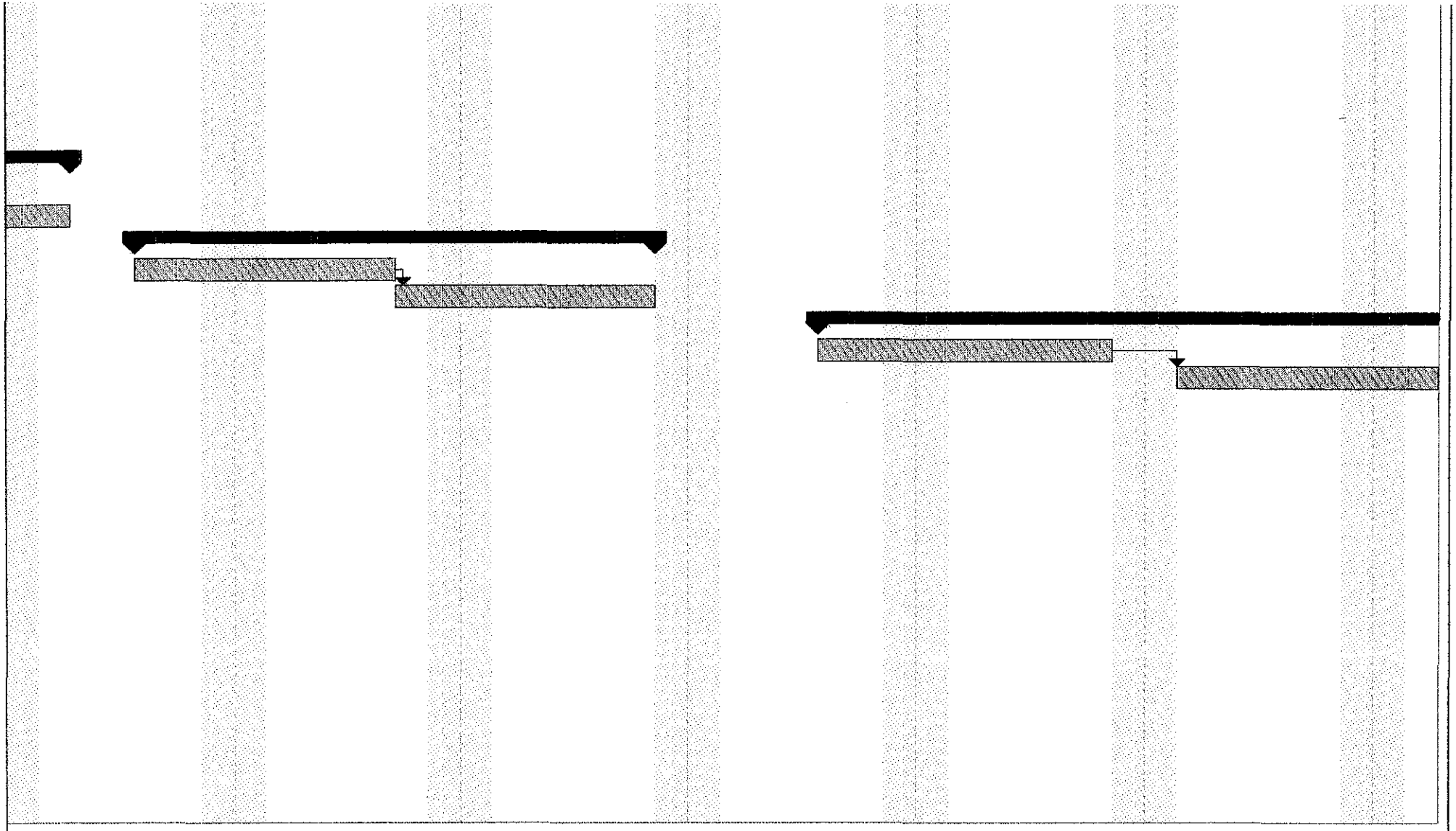
Project: ganchartfyp
Date: Mon 4/30/07

Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External Milestone
Deadline



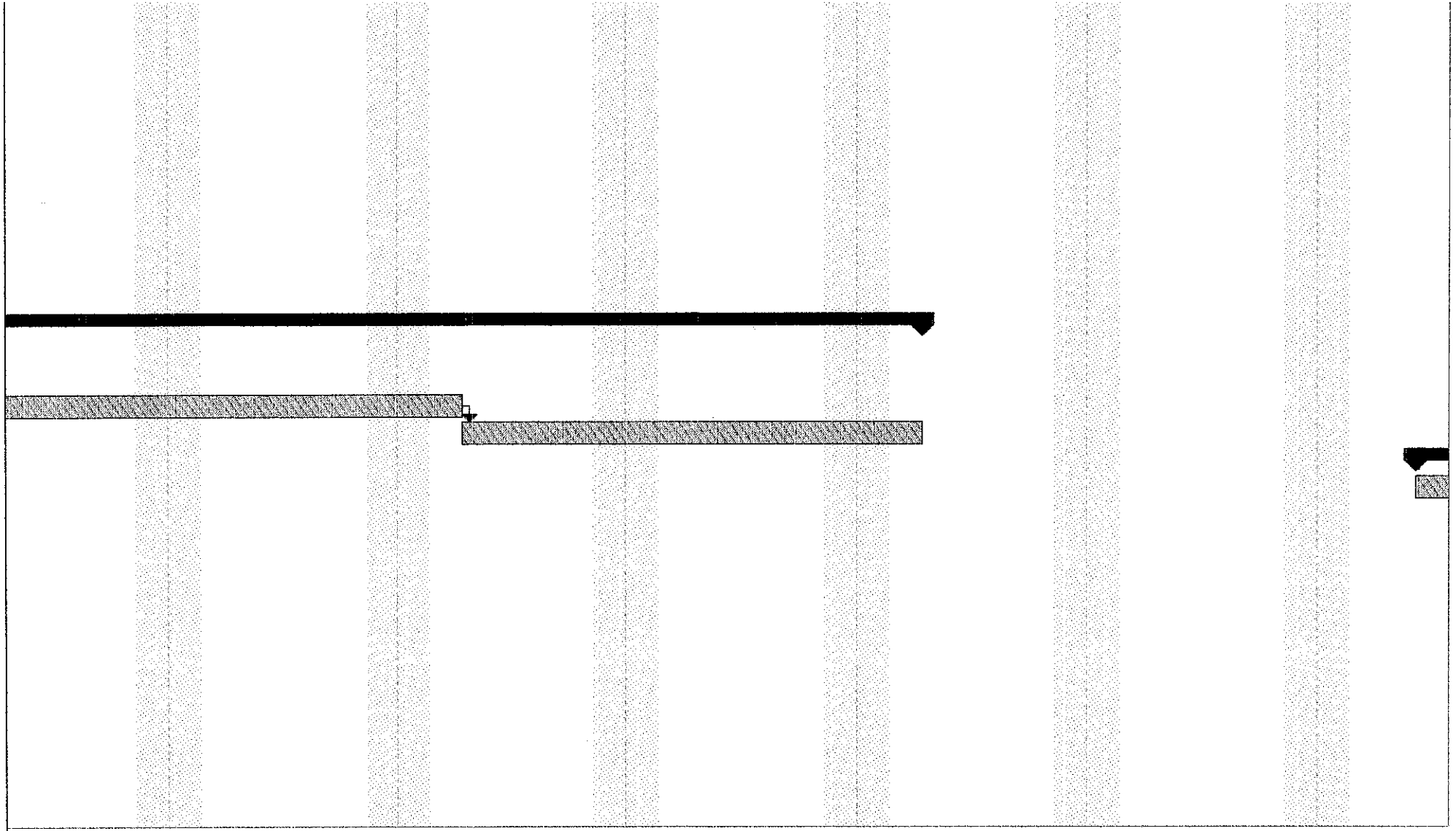
Project: ganchartfyp
Date: Mon 4/30/07

Task		Milestone		External Tasks	
Split		Summary		External Milestone	
Progress		Project Summary		Deadline	



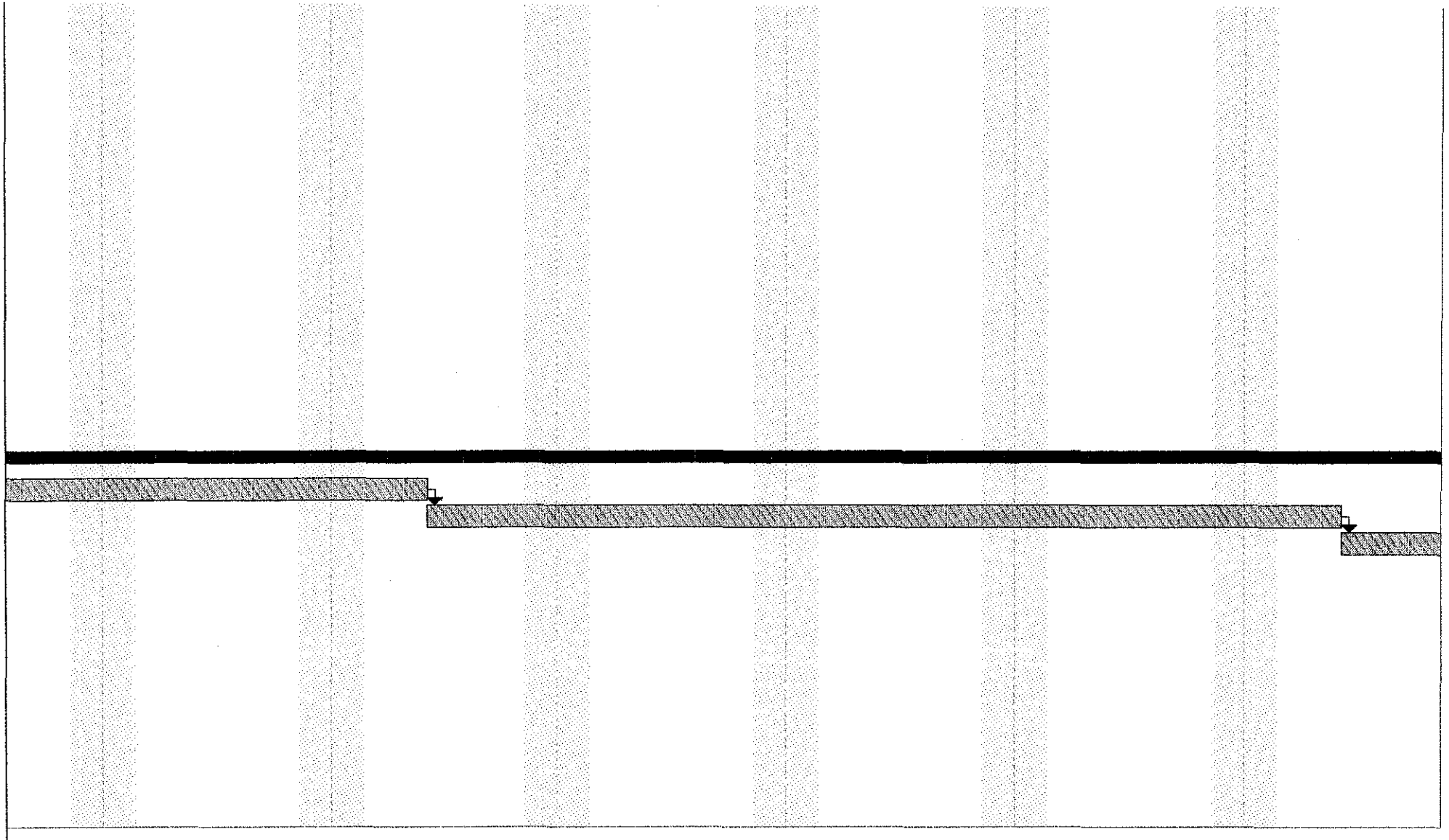
Project: ganchartfyp
Date: Mon 4/30/07

Task		Milestone		External Tasks	
Split		Summary		External Milestone	
Progress		Project Summary		Deadline	



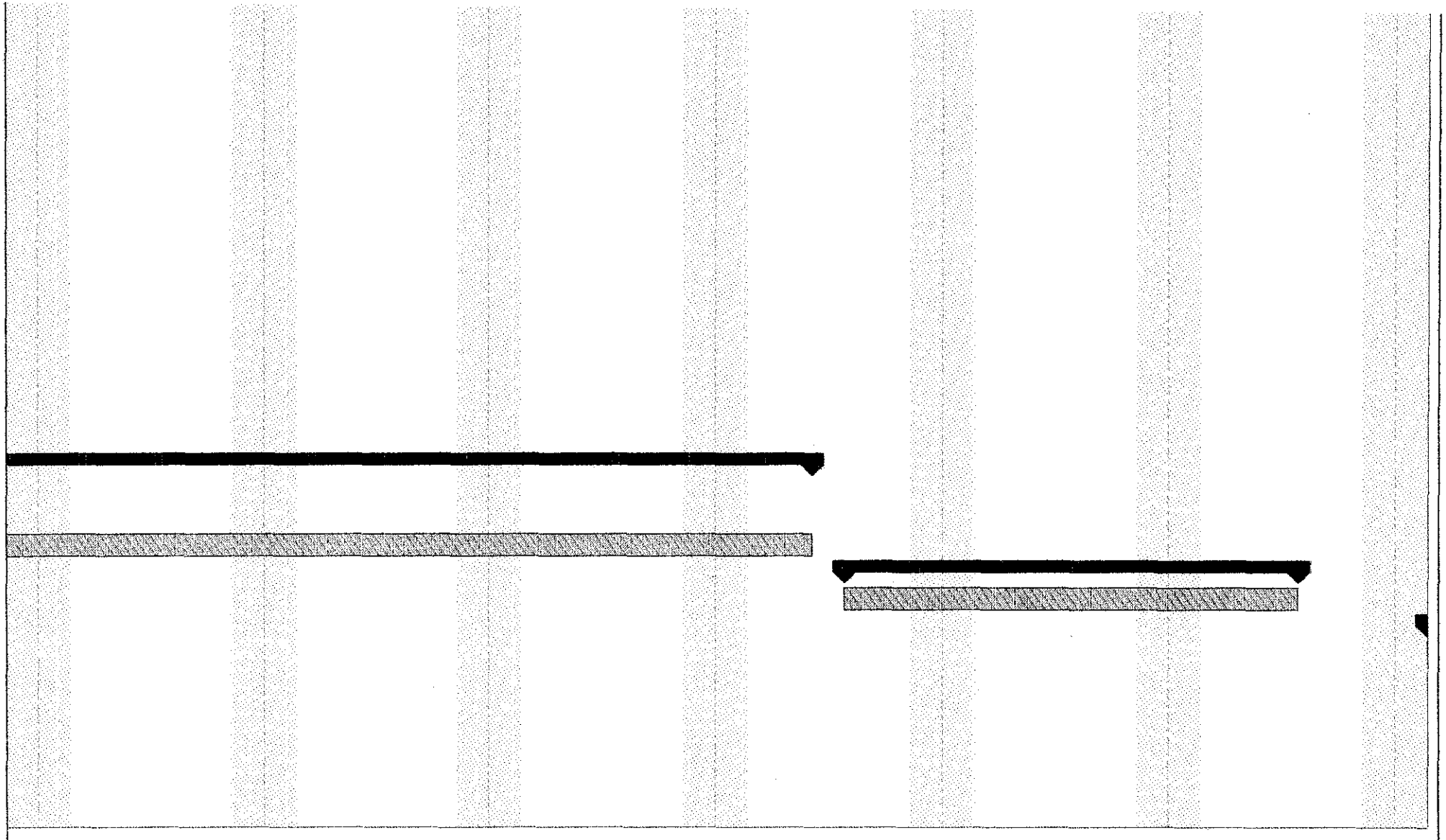
Project: ganchartfyp
Date: Mon 4/30/07

Task		Milestone		External Tasks	
Split		Summary		External Milestone	
Progress		Project Summary		Deadline	



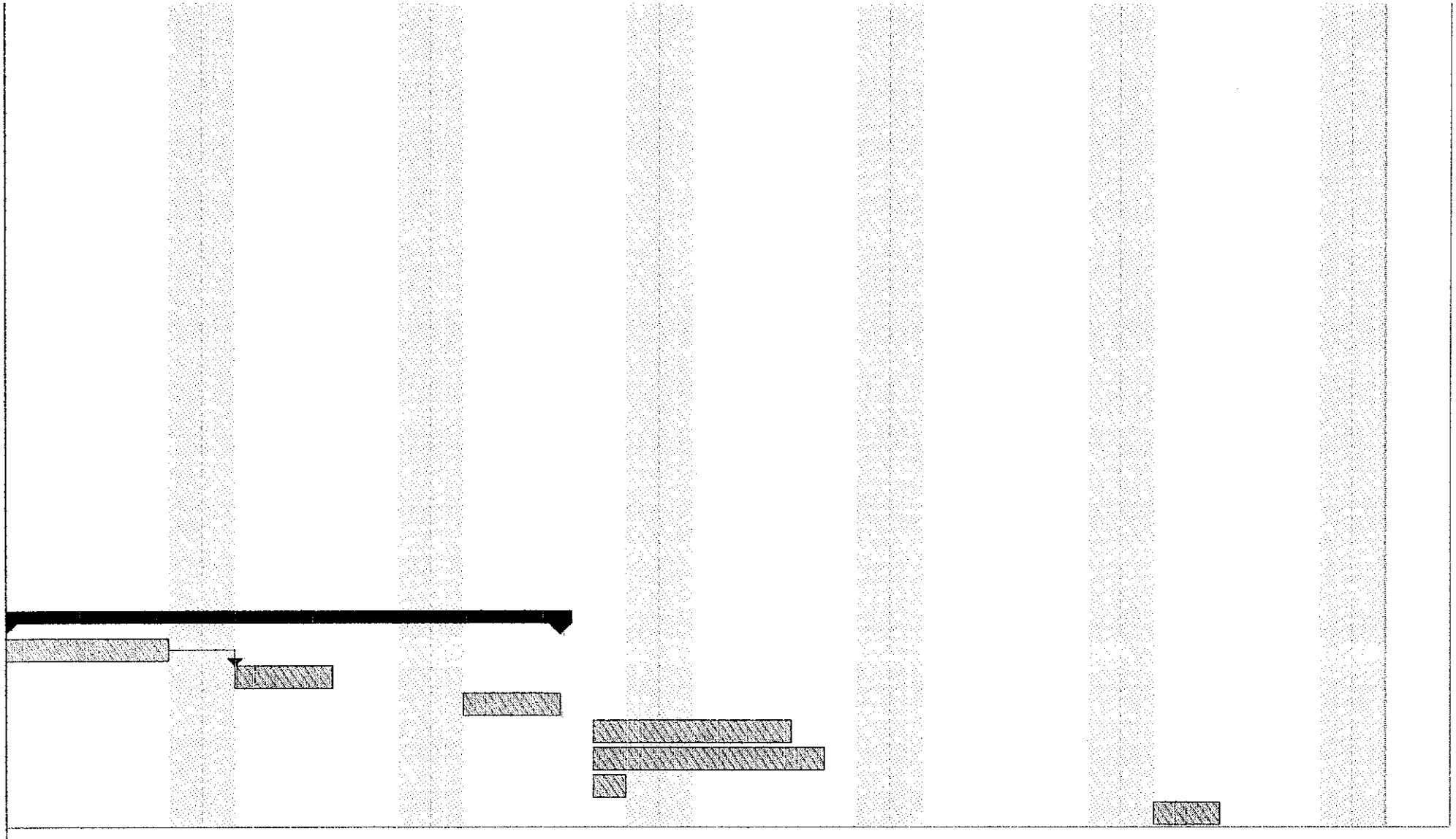
Project: ganchartfyp
Date: Mon 4/30/07

Task		Milestone		External Tasks	
Split		Summary		External Milestone	
Progress		Project Summary		Deadline	



Project: ganchartfyp
Date: Mon 4/30/07

Task		Milestone		External Tasks	
Split		Summary		External Milestone	
Progress		Project Summary		Deadline	



Project: ganchartfyp
Date: Mon 4/30/07

Task		Milestone		External Tasks	
Split		Summary		External Milestone	
Progress		Project Summary		Deadline	

APPENDIX B

LIST OF TABLES IN MOODLE DATABASE

Appendix B: List of Tables in Moodle Database.

Table
adodb_logsql
mdl_assignment
mdl_assignment_submissions
mdl_backup_config
mdl_backup_courses
mdl_backup_files
mdl_backup_ids
mdl_backup_log
mdl_block
mdl_block_instance
mdl_block_pinned
mdl_block_rss_client
mdl_blog_tag_instance
mdl_cache_filters
mdl_cache_text
mdl_chat
mdl_chat_messages
mdl_chat_users
mdl_choice
mdl_choice_answers
mdl_choice_options
mdl_config
mdl_config_plugins
mdl_course
mdl_course_allowed_modules
mdl_course_categories
mdl_course_display
mdl_course_meta
mdl_course_modules
mdl_course_request
mdl_course_sections
mdl_data

Table
mdl_data_comments
mdl_data_content
mdl_data_fields
mdl_data_ratings
mdl_data_records
mdl_enrol_authorize
mdl_enrol_authorize_refunds
mdl_enrol_paypal
mdl_event
mdl_forum
mdl_forum_discussions
mdl_forum_posts
mdl_forum_queue
mdl_forum_ratings
mdl_forum_read
mdl_forum_subscriptions
mdl_forum_track_prefs
mdl_glossary
mdl_glossary_alias
mdl_glossary_categories
mdl_glossary_comments
mdl_glossary_entries
mdl_glossary_entries_categories
mdl_glossary_formats
mdl_glossary_ratings
mdl_grade_category
mdl_grade_exceptions
mdl_grade_item
mdl_grade_letter
mdl_grade_preferences
mdl_groups
mdl_groups_members
mdl_hotpot
mdl_hotpot_attempts

Table
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mdl_hotpot_questions
mdl_hotpot_responses
mdl_hotpot_strings
mdl_journal
mdl_journal_entries
mdl_label
mdl_lams
mdl_lesson
mdl_lesson_answers
mdl_lesson_attempts
mdl_lesson_branch
mdl_lesson_default
mdl_lesson_grades
mdl_lesson_high_scores
mdl_lesson_pages
mdl_lesson_timer
mdl_log
mdl_log_display
mdl_message
mdl_message_contacts
mdl_message_read
mdl_modules
mdl_post
mdl_question
mdl_question_answers
mdl_question_attempts
mdl_question_calculated
mdl_question_categories
mdl_question_datasets
mdl_question_dataset_definitions
mdl_question_dataset_items
mdl_question_match
mdl_question_match_sub
mdl_question_multianswer
mdl_question_multichoice
mdl_question_numerical

Table
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mdl_question_rqp_states
mdl_question_rqp_types
mdl_question_sessions
mdl_question_shortanswer
mdl_question_states
mdl_question_truefalse
mdl_quiz
mdl_quiz_attempts
mdl_quiz_grades
mdl_quiz_question_instances
mdl_quiz_question_versions
mdl_resource
mdl_scale
mdl_scorm
mdl_scorm_scoes
mdl_scorm_scoes_track
mdl_sessions
mdl_stats_daily
mdl_stats_monthly
mdl_stats_user_daily
mdl_stats_user_monthly
mdl_stats_user_weekly
mdl_stats_weekly
mdl_survey
mdl_survey_analysis
mdl_survey_answers
mdl_survey_questions
mdl_tags
mdl_timezone
mdl_user
mdl_user_admins
mdl_user_coursecreators
mdl_user_preferences

Table

mdl_user_students

mdl_user_teachers

mdl_wiki

mdl_wiki_entries

mdl_wiki_pages

mdl_workshop

mdl_workshop_assessments

mdl_workshop_comments

mdl_workshop_elements

mdl_workshop_grades

mdl_workshop_rubrics

mdl_workshop_stockcomments

mdl_workshop_submissions

153 table(s)