Project Manager

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I am also indebted to my friends who had discussed, commented and made suggestions on the draft.

I would like to thank my husband, Mr Ravichandran and my son Vignesh for supporting me throughout the duration of writing this thesis.

Abstract

This dissertation describes a system to facilitate the on-line submission of student projects at the educational institution where I teach. The system includes some facilities for detecting cases of possible collusion. The dissertation covers the background of to the project, the requirement analysis, design and implementation of the system in Java. A prototype is now in operation and a critical evaluation of this is included.

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1. Introduction

1.1 Introduction

The Institute for Computer Studies (later Informatics) was established in 1983, in recognition of Asia’s economic growth fostering tremendous demand for skilled Information Technology (IT) manpower and knowledge based workers to build and sustain the rapid economic development in the region. In 1995, The Institute became an independent company and has since formed strategic training alliances with major software vendors including Microsoft, Lotus, Oracle Corporation and Sun Microsystems.

Informatics started in 1983 from humble beginnings, with only one Informatics Computer School in Singapore. Today, Informatics has grown into a worldwide network, with global operations in over 400 training and education centres spanning across 33 countries. Informatics aims to continuously provide its students with the best educational programs, through academic partnerships with world-renowned Universities and global technology holders. Informatics had trained over 450,000 students worldwide. In terms of turnover, Informatics is now comparable to the top 20 Nasdaq listed training and education companies. Today due to its strong focus on delivering customer-required products and services, Informatics has become a multi-national corporation with the worldwide reputation for providing high standards of training and educational services to delight all its partners and customers.

1.2 Sort of Business

Informatics core business activities are IT training and education, business training education and IT-related services and franchise operations. These are delivered through its five franchise products namely Informatics Computer School, Thames Business school, Computer Assisted Learning (CAL) IT centre, Regional Applied Computing (RACC) and also Cambridge Child Development Centre (CCDC). Informatics recently launched online learning and educational program and cyber campuses to complement course deliveries to students to reach out to the world market through the Internet by the name of Purpletrain.com.

1.3 Testing and Certification

Informatics is dedicated to the development and maintenance of academic quality relating to the conduct of courses, examination processes, curriculum development and many more.
Programmes conducted by Informatics:
IT programmes (Informatics Computer School)

- Diploma in Computer Studies
- Advanced Diploma in Computer Studies
- Diploma in Information Technology
- Advanced Diploma in Information Technology
- Diploma in Computer Engineering
- Advanced Diploma in Computer Engineering

Short Courses (Information Technology Training)
Business Programmes (Thames Business School)

Certificate, Diploma and Advanced Diploma in Business

Certificate, Diploma and Advanced Diploma in Administration

Certificate, Diploma and Advanced Diploma in Accounting

IT Knowledge Programmes

Desktop application courses

Web & application development courses

Systems & Network courses

Database Development

CompTIA courses

E-Business Courses

Intel Course

Over the past 12 years, over 6,000 professionals have graduated from the Institute's Diploma and Advance Diploma programs. Historically, 91% of the graduates have found positions related to their studies within six months and over 70% within three months of course completion.

1.4 Informatics Certified Professional Programmes (ICP)

ICP provides the training assessment tools and credentials that help keep the student technically current, personally motivated and professionally challenged. Unlike other certification programmes, Informatics Certified Professional learning road maps focus on evolving job role in complex IT environment.

1.5 PurpleTrain.com

PurpleTrain.com is Asia's first e-learning service provider offering a one-stop service for Business and IT education programmes, corporate training courses and education-related services.

By combining innovative technology with world-class training content, www.purpletrain.com delivers anytime, anywhere learning. It offers both companies and individuals a high value, quality and effective online training solution. Over 300 online courses are available ranging from Certificate, Diploma, Degree to Master programmes, in business and Information technology.

Iinformatics has ten different centers in Singapore. The main courses conducted in Woolands centre are DCS, ADCS, DIT and ADIT. The system, which I am developing, is for the centre where I am working (Woodlands, Singapore). The system mainly focuses on DIT and ADIT courses, which follows project, based assessment.

1.6 Current System

1.6.1 Overview

For exam-based programmes Informatics uses the traditional method. All students assemble in a common place to write their exam and the scripts will be marked and moderated by a group of lecturers. There is no problem with the exam-based programmes.

For coursework-based programmes such as DIT (Diploma in Information Technology) the students are assessed on projects, which they submit at the end of their individual modules (14 weeks). The current procedure is as follows.

Individual lecturers collect the projects for their own modules and mark the project and check the program manually. If the class size is more than 35, two lecturers will teach the same module. Then the projects will be sent out to HQ (headquarters) for moderation. For a class of 40 students, each lecturer will receive a stack of documents. It is very difficult for lecturers to keep track of all the projects. Each project softcopy needs to be checked for its functionality. Each lecturer teaches a minimum of two to three DIT classes and end up with large number of documents to store. The major problem with the current system is there is no central repository and it is very difficult to identify plagiarism in coding.

1.7 New Proposed System

The new system will help to eliminate the problems and limitations caused by the manual system. The objectives of the new system are to reduce the number of complaints from students by providing value added services (with the help of the system) and increasing the staff productivity by computerising the manual processes. The system must also be user-friendly. All these will help the centre save enormous amounts of time, money and resources as well as increase staff job satisfaction.
With the above objectives in mind, we propose the following requirements for the new system:

- to provide a single repository to hold project submissions;
- a GUI front end to enable student to submit their projects
- a GUI front end to enable lecturers to view, grade, retrieve and analyse projects
- adequate access control facilities to protect against unauthorised access;
- a mini AI engine that allows the system to warn the lecturers of possible plagiarism.

The new system will overcome the problems identified in our current system, as follows:

By providing a central repository, all students will be allowed submit their program and document online. This will eliminate loss of documents and make it easy to keep track of their submission, to check the program, to transport projects electronically to HQ.

Students can upload their project electronically and this will reduce the time taken to keep track of the project by the admin staff.

Lecturers can view the project electronically and grade it and analyse the project code for plagiarism.

All students will be given an id and password to login to the Project Manager to prevent unauthorised access.

By using the new system it avoids physical storage of large number of projects and able to identify the plagiarism in coding.

1.8 Life Cycle Model Used

It is important to understand how the system will be useful for the users and how the current system is functioning. To do the detailed analysis and design and develop the new system, I am using the Waterfall Model to develop the system. The waterfall consists of analysis, design, code, test phases.

1.8.1 Fact Finding Techniques

The fact-finding technique, which I am using for analysing the current system and to find the users requirement, is the questionnaire. Questionnaires are very cost effective when compared to face-to-face interviews. This is especially true for studies involving large sample sizes and large geographic areas. Written questionnaires become even more cost effective as the number of research question increases.

1.8.2 Design Technique

Although most modern days computer systems are developed using a defined methodology this has been always not the case, in fact many early computer applications were implemented without the aid of an explicit information systems development methodology (Avison et al, 2003). Early information system projects would be developed in the way that the programmers saw first, which would often result in the requirements of the users not being fulfilled.

1.8.3 System Modelling

Throughout the requirements determination process a colossal amount of information has been discovered that has indicated current processes and certain future requirements in addition to what data items need to be recorded and the processes that must take place in the new system, so far none of it has been recorded in appropriate manner.

Having completed requirements determination process the developer recognised the importance of documenting the process of the system she had just investigated. In order to gain a better feel and understanding of the system the developer has chosen to coherently represent the information gathered as part of the requirements determination using a variety of modelling tools, including process modelling, requirements catalogue, data dictionary and class diagrams.

When it comes to recording the result of analysis, it was very difficult to decide which design tool to use. I compared the tools such as Flow charts, E-R diagrams, Data Flow Diagram, Object- Oriented Diagrams. And I have concluded that DFD is more suitable for the current system (Analysis) and Class diagram is more suitable for my proposed system (Design) as I am using Java as my developing tool.(Appendix 2)

The design technique, which I am using for both current and new system is levelled DFDs (data flow diagrams). DFD is a process oriented. It can be used to describe both existing and planned system. Level 1 DFD shows how the system is made up from processes, data stores and data flows. The level 2 DFD describes how the individual processes are made up from sub processes, data stores and data flows.

1.8.4 Process Modelling - Data Flow Diagram

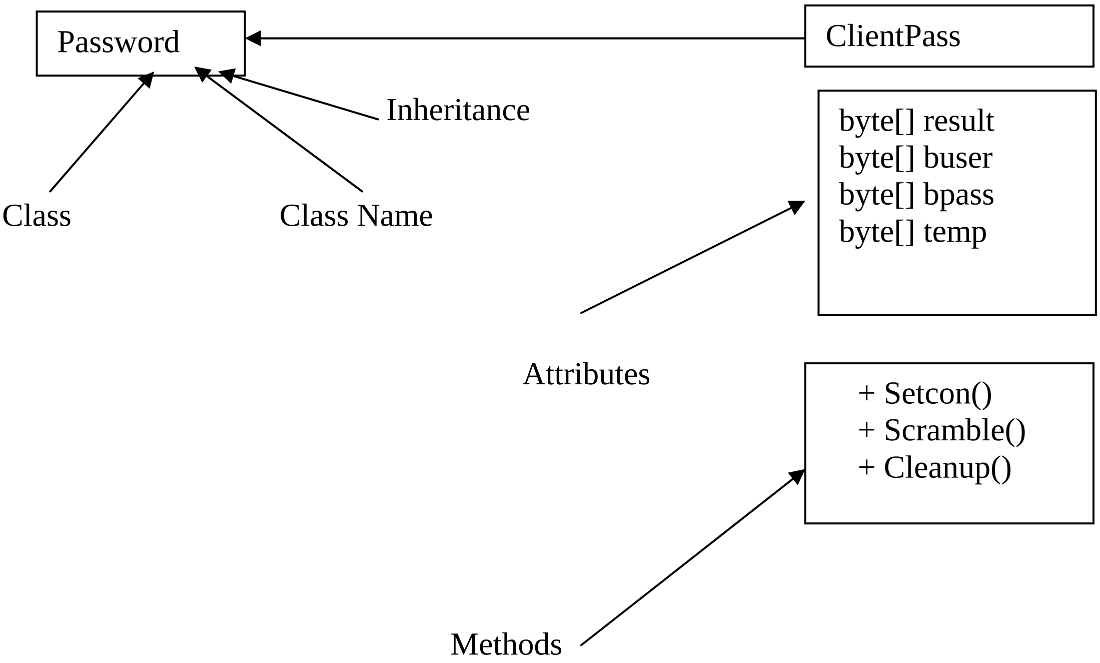
Hoffer (2002) describes process modelling as graphically representing the functions or processes, which capture, manipulate, store and distribute data between a system and its environment. The most standard and almost common way of carrying out this process has been to develop Data Flow Diagram for the current system.

Data Flow Diagrams (DFD) are crucial elements in the system analysis process as many other techniques depend on them (Griffiths, 1998). DFDs are helpful in the analysis process as they are not only amalgamate and bring structure to the mass of information that has been discovered (Griffiths, 1998) but there lack of ambiguity and ease of understanding makes them a powerful communication tool (Weaver et al, 1998) between the system analysts and stakeholders.

The deliverables from this process modelling is a context level DFD. The main purpose of this first DFD is to show and fix the boundary of the system showing its interaction with external entities (Weaver et al, 1998) and it can be seen in Fig 2.1.

1.8.4.1 Class Diagram:

A class diagram describes the classes that make up a system and the static relationships between them. Classes are defined in terms of their name, attributes (or data), and behaviours(or methods). The static relationships are association, aggregation and inheritance. The notation used in class diagram are as follows



Flowcharts are the classical diagrammatic tool for designing either system or program logic. They use symbols and interconnecting lines to show a system's overall work flow; showing what is being carried out, logic and sequence of specific program operations. Flowcharting is, however, more of a sequential approach. Activities are represented in a page from top to the bottom and from left to right. There must be a start point and an end point. Activities are commonly ordered in a determinable sequence.

1.8.5 Coding

The design will be converted into workable solution by using Java programming. Java byte codes require a virtual machine to interpret them and execute the instructions natively. For this new system I will be using Sun’s JDK 1.4.1 and the GUI design will be used based on Swing components.

I have chosen to implement an “intelligence” to detect plagiarism. The book Constructing “Intelligent agents with Java” provides a good introduction to some AI (artificial Intelligence) concept and implementation.

My initial plan is to create a rule based reasoning system to analyse ASCII source files. According to this, AI rule set will be configured to recognise java language and be able to pick out plagiarism based on rules and this component should also be expandable to accommodate other languages like C, JavaScript etc. This proves to be too daunting task to be accomplished within the time frame that I have. So, instead of using rule-based method, I have implemented a signature based method. Regular expressions are used to match patterns. As of Jdk1.4.1, Java supports regular expression.

When creating application in Java, I have decided to use Swing components. This is to create consistent look and feel, but also to take advantage of functionality more advanced than that provided by native platform equivalents, such as AWT (Abstract Windows Toolkit). The basic difference between Swing and AWT is that Swing is implemented with no native code and therefore known as a “lightweight” component in contrast to “heavyweight” AWT native platform component.

1.8.6 Testing

Testing any artefact of systems development, whether it is hardware or software, is always an important activity however it is often squeezed to the end of a project. As I am aware of the importance of testing the artefact from the very start of the project, I have decided to use the approach of integrated testing throughout the software development process.

1.9 Technical Environment

Currently all Informatics centres are equipped with individual server. The server used in the centre is a File server. A File server network is made up of Pc’s as well as a Server computer. The server is usually responsible for the applications, and the information storage whereas the Pc’s carry out most of the processing. The server uses Windows 2000 operating system and all users Pc’s are running with Windows 98 operating system. All stand alone Pcs are loaded with compilers such as Java Ski 1.4.1, C programming and Visual Basic 6.0. This server is connected with all the labs in the particular centre. All labs have standalone PCs that are connected to the server. All lecturers are equipped with Desktop Pc for their individual use. Each centre has a student corner, which consists of few numbers of PC’s for student’s use.

1.9.1 New system requirement

My application Project manager is based on client server model. It will use java sockets for network communication. The server portion will do the actual storing and maintaining of student’s project files. The client GUI front end is based on Swing. It will allow students to submit their projects and lecturers to view, grade, retrieve and analyse projects. By using client server model, a single repository is possible.

2. Analysis

2.1 Introduction

The overall aim of the systems analysis section is to gain a thorough understanding of the current system, the environment in which it operates in and to ascertain the future requirements of the proposed system.

Although Yourdon (1989) argues that a great deal of time will be wasted modelling the current system in detail (Bennet et al, 1999), the developers view on this stage of the project is a mixed one. Whilst recognising that it is important to gain a clear understanding of the problem domain and to elicit the users’ requirements as precisely as possible, it is also recognised that this stage is one that could be possibly be iterative, as users’ needs and options develop over time. However, given the developers recent history with the company in question she feels that she already has a good insight into the current process and procedures in place and as a result a considerable amount of time will be saved.

Aligning with the analysis phase of waterfall model, this requirements elicitation and analysis process is an integral part of the lifecycle and will be addressed by the developer using some of the more traditional methods, in order to maintain a clear understanding of the current system and its environment.

Currently there is a manual system, more individual ways of doing things. The next part of this analysis section will put the problem in context before going onto the requirements determination process, determining what people do, how they do it and the volumes of works involved. The existing system has then been modelled to gain a better understanding for the flows of information before the section concludes with the full set of documented user requirements.

2.2 Fact finding techniques used

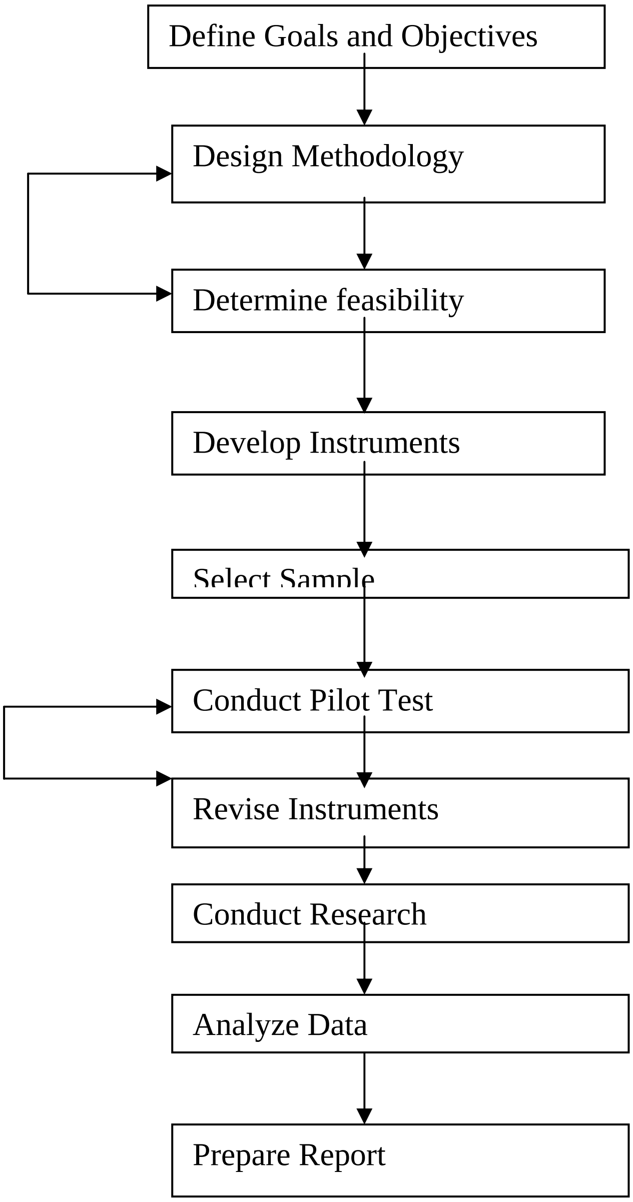
A survey was conducted on the intended users to find out functional requirements of the "Project Manager". Another purpose of the survey is to find out how I can re-engineer the work process so that extra features can be produced when designing the software.

Questionnaires method was used as part of fact-finding procedures. Questionnaires were completed by a total of 50 students and Lecturers. The Questionnaires were given to the appropriate individuals to fill up. Specific set of questions was used in the Questionnaires. Arrangement was made for the participant to complete the questionnaire.

2.3 Questionnaires

Questionnaires were distributed to 50 participating students and lecturers. Open and closed questions were used.

Questionnaire research design proceeds in an orderly and specific manner. Each item in the flow chart depends upon the successful completion of all the previous items. Therefore, it is important not to skip a single step. Notice that there are two feedback loops in the flow chart to allow revisions to the methodology and the instruments.



2.3.1 Things to take note of when using Questionnaires

Too much often some people are using the questionnaire as a means to gather ideas. In doing so, they hope to find clues which will enable them to go further down the road. Such a perspective is a total loss of time and energy. It will never be repeated enough, if you do not have any measure, the construction of the tool is premature.

Many researchers underestimate the time required to complete a research project. The following form can be used as an initial checklist in developing time estimates. The best advice is to be generous with your time estimates. Things always take longer than we think they should.

Task	Hours Used
Goal Clarification	2
Overall Study design	2
Selecting Sample	N.A
Write the cover Letter	0.5
Conduct Pilot Test	1
Revise Questionnaire (If necessary)	0.5
Data Entry and verification	1.5
Coding open ended response	1
Analyzing data	1
Preparing the report	1
Printing and distribution of the report	1.5
Total Hours	12 Hours

2.3.2 Advantages of Questionnaire

Questionnaires are cost effective compared to face-to-face interviews. They are easy to analyse. Data entry and tabulation can be easily done by computer software packages. It reduces bias. There is uniform question presentation and no middleman bias. The researcher's own opinions will not influence the way respondents answer questions.

2.3.3 Disadvantages of questionnaires

The main disadvantage with a written questionnaire is the possibility of low response rate. Sometimes it is simply not suitable for some people. The sample questions distributed to the students and lecturers can be seen at Appendix 1.

2.4 Description of current system

In Informatics, student projects are submitted manually as a bound document with accompanying floppy disks and a CDROM holding the source files. The following problems are identified from the analysis phase.

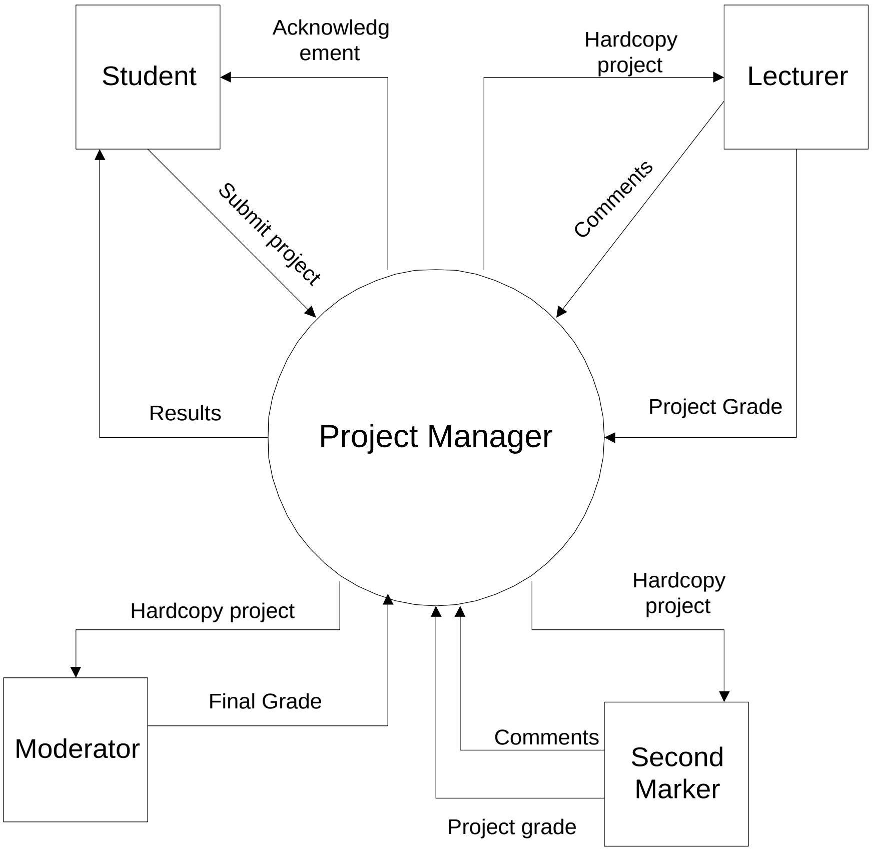
A serious problem is in maintaining and handling the mass of student projects. For a class of 35 to 40 students, a lecturer will end up receiving a stack of project documentation. There is difficulty in handling and keep track of projects. While space is one problem of the current system, it is also difficult to keep track of who submitted what and when.

Each document comes with a floppy or a CD that contains the sources. Floppies are easily damaged and not a reliable storage. Both floppies and CD-ROMs can also be misplaced.

If each project needs to be reviewed by a second marker, there will be the problem of transporting the stacks of documentation to the reviewer.

As it is a modular based programme, it is possible for someone who has completed a module to pass on a copy to his fellow classmate who has not done the module. There is nothing wrong with such exchanges if proper recognition is given to the work of others. In fact such exchanges of ideas and information could improve the overall academic standard. However the problem arises when the student misuses it. Rather than using such material as references, someone could possibly copy much of the materials and pass it off as his or her work.

The above points highlight some of the problems with the current system. My project will attempt to build a Java based application that could offer a solution to some of the points above. I call my application “Project Manager”. And henceforth all references to my application will use this name.



Context data flow diagram- Fig 2.1

2.4.1 Requirements Catalogue & Data Dictionary

For the developer to begin the production of the final artefact, a comprehensive list of all the data items, including structure, type, length etc. was required as well as a list of processes to be carried out by the system. From reading around various development methodologies the developer has sought to employ a variety of techniques to record this vital information.

As ongoing, almost running list, I have used the idea of the requirements catalogue, to record requirements as they were identified, which as well as a textual description of the catalogue entry will have a defined priority as well (Weaver et al, 1998) and can be seen in appendix 3. The data items themselves have been documented and will be stored in the data dictionary (Appendix 4), which has been carried by building on the concept of the Gane & Sarson style, owing to the developers' previous academic experience on the work of Garry Griffiths(1998).

2.4.2 New System Requirements

My application, Project Manager, is based on the client/server model. Currently one of our online education Purpletrain using this technique. Purpletrain is purely an online education system. The student is taught online and they will be submitting their project online. The

Purpletrain system can support the requirement of central repository for the new system (project Manager).

The first option was to get the support from Purpletrain for the submission of taught course project online. According to the management, as the Purpletrain operates worldwide and currently the server is loaded heavily. And the management of Purpletrain is not ready to support Project Manger.

The second option was to make use of the service of plagiserve.com. Plagiserve.com works as follows. The student needs to register and become a member of plagiserve.com. It is mandatory that the student needs to check for plagiarism by using Plagiserve.com and submit the plagiarism report together with their final document. Based on the percentage-hit rate, the student can be assessed. Here the responsibility goes to individual student. The problem with this system is this service can detect the plagiarism for the information taken from Internet only. This system is more suitable for research-based projects.

The requirements for the new system are client and server. All centres are equipped with a servers and clients. The objective of the project is to create a prototype using Java. This prototype includes an interface for student to submit their project and an interface for lecturers to view and grade students' projects. Simple plagiarism identification is also included in the server portion.

The system Project Manager is initiated due to increase in costs and the limitations of the available system. In order to reduce the cost, management consider the option of replacing the project manager with the current manual system.

Based on the findings above, it can be concluded that the school needs a better online submission for projects. The students and the lecturers support this system unanimously.

2.5 Requirement Analysis

This section discusses tasks carried out during the analysis phase of the project. Analysis defined by Hoffer et al as “ fundamentally an intelligent activity in which analysts capture and structure information”. This information captured relates to the project domain and its origins, objective of the process and current system utilised.

When performing analysis, information should be obtained from a wide range of sources to maximise the analysts understanding. This concept was utilised when determining the requirements for the project. Questionnaires were used to obtain information from various sources.

The information gathered, identified that there were two different categories of user who have dissimilar needs for the system and data.

Student Users

Lecturer Users

Once this information had been gathered, the next step was to structure it in a manner that is unambiguous, concise and accessible to others (including non technical personnel) [Yeates et al, 1994] tructured techniques are typically produced to model existing processes, however these can be extended to encompass models of the required system. Within this project various techniques were used to document information following

Data Flow Diagram (DFDs)

Sequence Diagram

Process Tools

Data Dictionary

A mixture of tools was used, because each has their own strength and weaknesses.

DFD model both the flow of data and external information while sequence diagram provide more detailed analysis of how external sources interact within the system. Following these two stages, a set of requirements can be drawn up depicting the desired functionality of new system. The following two subsections outline the main functional and non functional requirements.

2.5.1 Functional requirements

Students will be able to:

1. login the system as a student with respective password;
2. identify themselves with their names and 12 digit ID and the lecturer name;
3. select the module for which they are submitting their project;
4. submit their project as a single folder. This folder can have any number of files;
5. get the confirmation that the project has been correctly submitted.

Lecturers will be able to:

6. login to the system as a lecturer with respective password.
7. view the lecturer screen
8. retrieve students' projects for a particular module, term and year.
9. grade the project.
10. analyse the project for plagiarism.
11. receive comments for the particular project from the server.

Security

All users are required to log into the system with password.

Data store

A mechanism for bulk inputting user data must be provided.

2.5.2 Non Functional Requirement

All applications are stored in text files.

Upload time must be reasonable.

Information must be viewable for Lecturers.

The remainder of this chapter discusses the main considerations made during the design phase of this project. Design is best described as implementing independent models to represent information flows, how users interact with the system and how certain mechanism will operate in a new system.

2.6 System Architecture

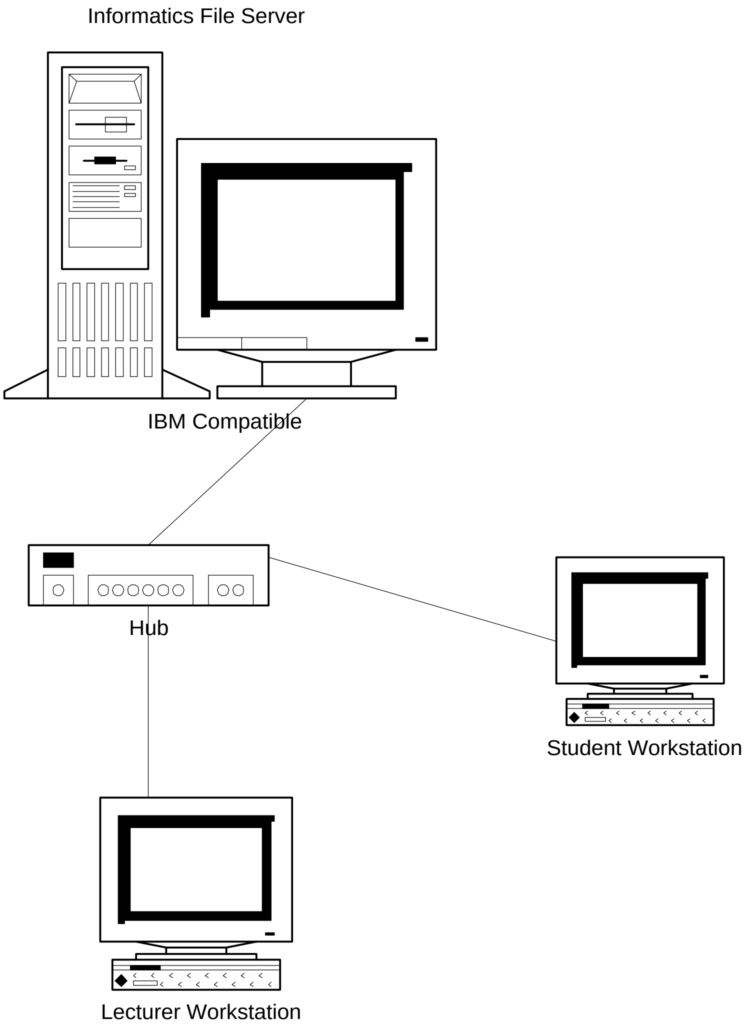
The system architecture used in this project is Client/Server based model. This project uses communication mechanism linking some sub processes. The sub processes in this system are

User Interface

Processing Management

Storage Management

The client handles the Interface layer and the Server handles both processing and storage management.



2.7 Summary

This chapter has demonstrated to the readers the way in which the developer has gone about eliciting the requirements from current manual system. By investigating the current practices of the project manager has been able to learn in more detail what data and processes are in the current system and what information needs to be stored in the new system. The list of functional and non-functional requirements will now provide the input to the Design chapter, which will look into how these requirements will be implemented into the new system.

3. Design

3.1 Introduction

Project Manager is built using Java, an Object Oriented language. I strive to build Project Manager in an object oriented and modular way, so that each component can be updated and changed independently of others.

My approach is slightly different from the normal system development life cycle. First, I analyse the problems and come up with the solution (Project Manager) with the set of features that I want it to have. Then I started building the application component by component. Then I review my overall design and plan along the way.

I started small module, build up a component that works, then go on to the next and so on. At each stage, I will plan how the components will tie in together and work as a whole. Some rewriting of code may be necessary, but my design will be modular and component based. Building component-by-component make a difficult task easier to understand and implement. Since each component is tested along the way, the final test will not throw up too many bugs, as most would have been eliminated earlier.

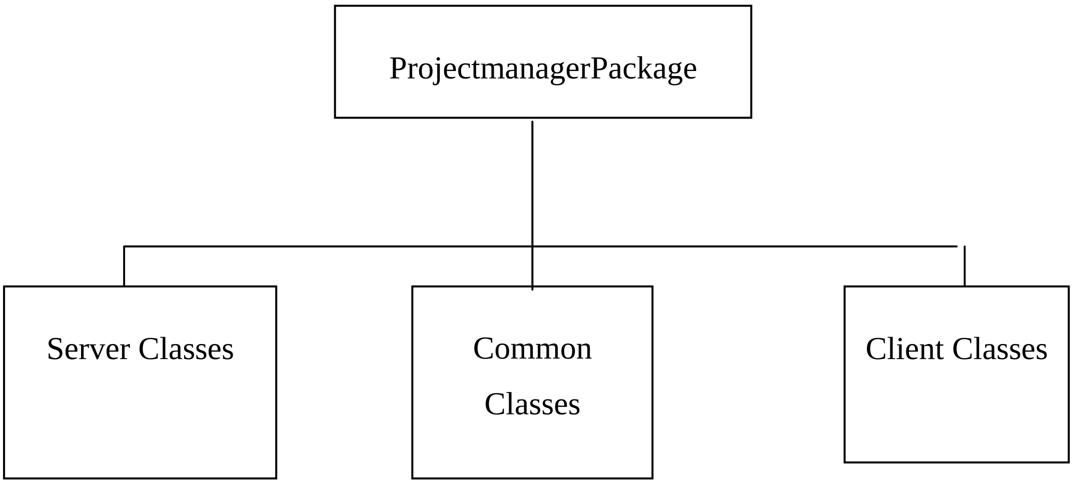
Once I have the entire application working, then I look at its overall design and do some cleanup and optimisation, recoding components and modules if necessary. Reviewing the design and recoding, will lead to more efficient and elegant design application.

As Project Manager is client/server based, a lot of trace information is needed. For each component and class that I build, I have sprinkled System.out.println() to print out variables etc. This allows me to trace the progress of the program and to debug errors. Such traces are also useful in verifying that things are working the way that I intended. Some of them can be removed for production version of application.

Design Layout

This section describes how the various classes are organised. At the top most level I have organised all the classes under the same package, called Project Manager package.

Projectmanager class hierarchy



The figure above illustrates the top-level design that consists of three sub groups namely Server class, Common class and the Client class.

The server group mainly deals with the incoming client connections, they are also responsible for carrying out the tasks that the client requests, keeping track of and maintaining the storage of student projects. Another example is the configuration file, both the server and the client uses the same configuration files.

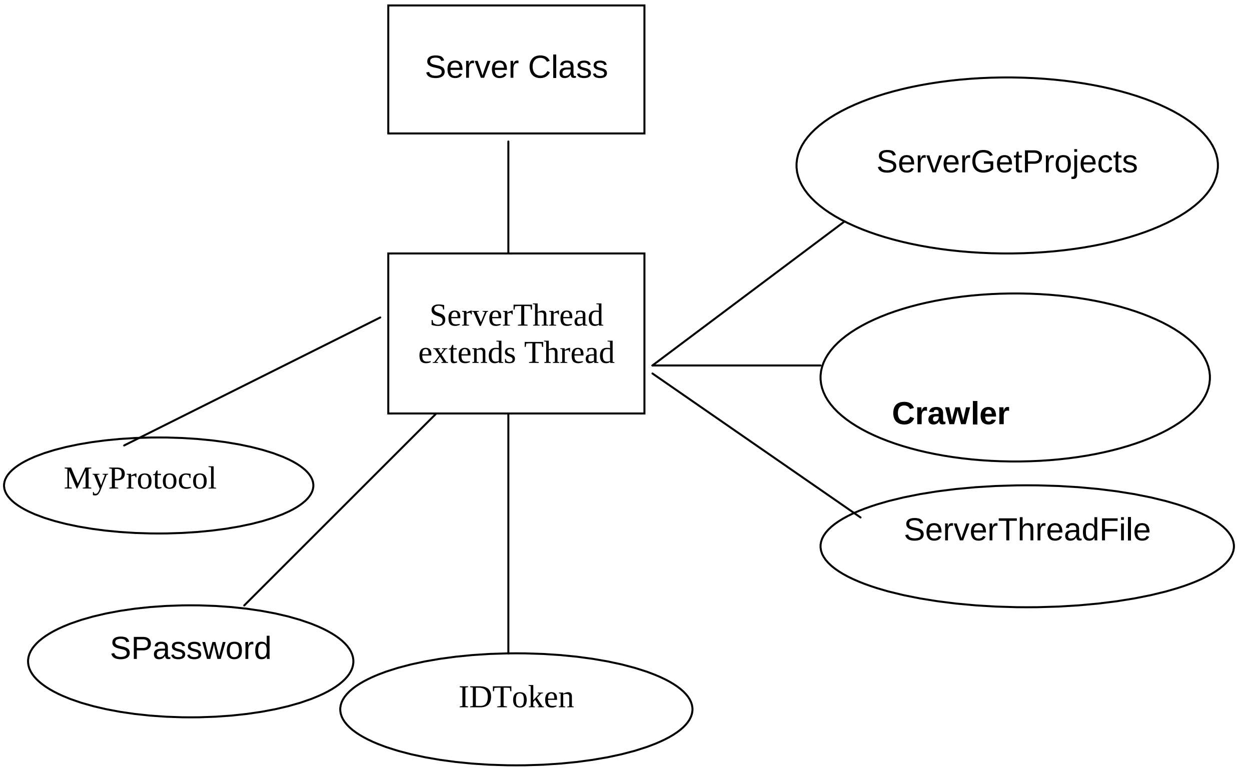
The client file contains all GUI (Graphic User Interface) classes, the connection to the server, and the instructions(protocol) to be sent to the server. Now we will move on to the details of sub groups.

The following table shows the classes that are in the server group and a summary of what they do. Detail of classes and methods can be referred at appendix 4.

3.1.1 Server Group

Class	Function
Server	The main server class that starts the server and listen for incoming client connections.
ServerThread Extends Thread	A new thread will handle each incoming connections. This class is the ServerThread that will start to handle a Client connection.
MyProtocol	This class defines the six stages that each single ServerThread can handle
Spassword extends Password	This handles the password and userid decryption and verification process.
IDToken	The class that store a single authorization token. This is make up of username and their corresponding encrypted password.
ServerThreadFile	The class that handles the incoming student project files and details, storing these in appropriate places. Also responsible for creating the index file that allows the student details to be found later.
ServerGetProjects	Class to handle request student projects, it will handle finding and sending the right details and files to the client.
Crawler extends Thread	This class generates signature files for module sources and comparing them to check for plagiarism. It is a small AI engine.

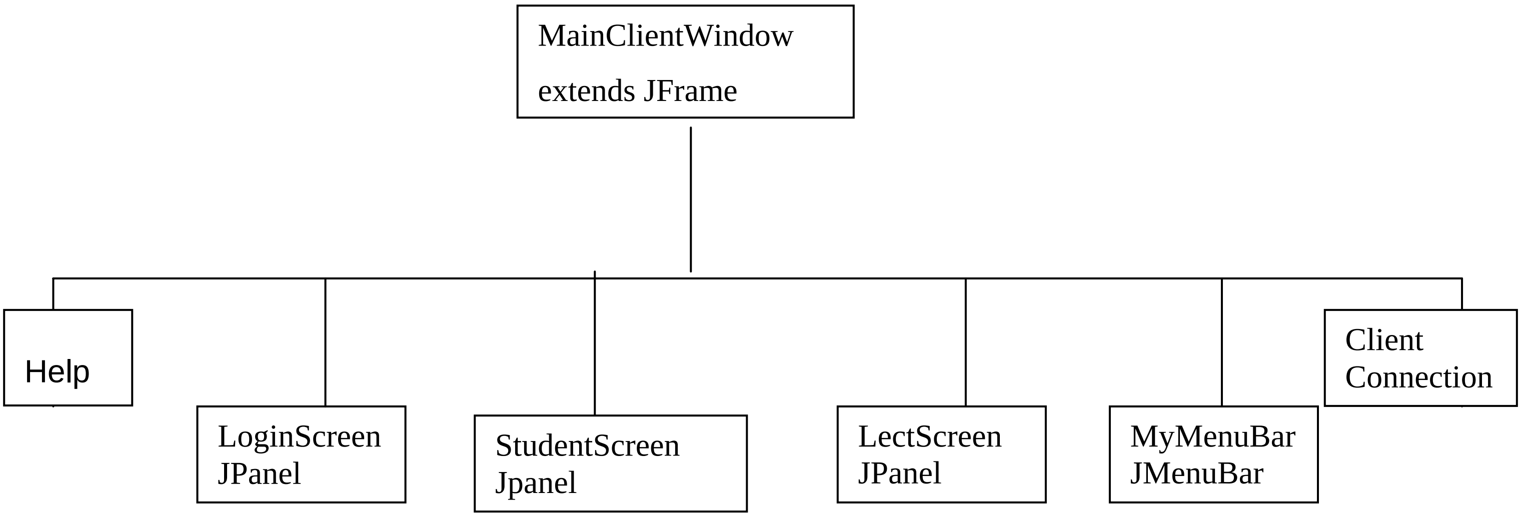
The following diagram illustrates how the classes are related.



3.1.2 Client Group

Class	Function
MainClientWindow extends JFrame	This is the main class from which all the other client GUI classes will be launched.
MyMenuBar extends JMenuBar	The class that implements the menu bar for all our client GUI screen.
ClientConnection	This is the class that provides the socket connection to our server.
ClientPassword extends Password	The client password class is responsible for encrypting the userid and password.
LoginScreen extends JPanel	The first GUI screen that user will see. It contains field for userid and password.
StudentScreen extends JPanel	This is the class for the student GUI screen, this is where the student can submit their projects.
SubmitServer	This is the class used by the StudentScreen class for submitting the projects to the server.
LecturerScreen extends JPanel	This id the class for lecturer GUI screen, whether the lecturer can view, retrieve, and analyse students projects.
LectGetStudent	This is the class will handle getting student project details from the server.
LectRetrieve	This is the class that enables the setting of grade and comments for a particular student.
MyTableModel extends AbstractTableModel	Thus handles the data being shown by the lecturer screen student project table.
Help extends JDialog	The help class that displays help information.

Relationship of Client group



There are classes that are used both by Server and Client. The following table shows the classes and their functions.

Class	Function
ReadConfig	For parsing the configuration files of client and server.
Password	For providing the basic pass encryption features.
StudentProject	A class for holding the details of a single student project.

Besides these three main group of classes, I have also included a utility called PasswordCreator. This is a java program that allows the creation of encrypted userid and password file. This can be used to generate the serverpass.cfg file.

3.2 Input Specifications

The following table shows the input data that a student can enter at the student screen front-end.

3.2.1 Student Input Specifications

Field	Format
StudentID	12 numeric digits
StudentName	Alphanumeric (no length limit)
LecturerName	Alphanumeric (no length limit)
ProjectTitle	Alphanumeric (no length limit)
ProjectSummary	Alphanumeric (no length limit) Generate examination confirmation list
Term	Standard selection (eg. Term1, term2, Term3,Tterm4.
Module	Standard Selection that is fixed(eg.IT406—Java Programming, IT413---Oracle)
ProjectFile	A single project documentation file in Binary format(No size limit).
Project Sources	All the source files in a source directory inclusive of all directories relative to this base source directory.

3.2.2 Lecturer Input Specifications

Field	Format
Grade	Integer
Comments	Alphanumeric (Unlimited length)

An auto generated data field that cannot be amended is the date. It is stored internally as a long type representing milliseconds since 1st Jan 1970.

3.3 File Specification

Project manager currently doesn’t use any database. It stores everything a plain text file and uses the file system hierarchy provided by the operating system to manage all the text files. Each module that a student take can have a total of seven data files. The following table shows these files and their respective uses.

File Name	Uses/Explanation
Index.dat	The main index file containing the student id, student name, lecturer name, Project Title, Term, Module, Project file path, Project filename, Source directory, submission date. Each field is stored in a single line.
Summary.dat	Stores project summary.
Grade.dat	Stores the grade for this module as well as many comments. The grade field is always stored in the first line. All subsequent lines are comments.

Grade.old	Backup file for our original grade file when AI engine kicks in, it may modify the comments in the grade file.
Crawler.dat	Unique signature file consists of multiple lines that are extracted form the source files.
Ai.dat	Stores the number of Ai hits as a percentage.
tmp	A temporary working file used by AI engine.

In all these files, each unique field is stored in a single line in the order listed in the table. The summary.dat contains multiple lines, but it stores only a single data field, project summary.

3.3.1 Configuration File Format

Besides these seven data files used to store information, Project Manager utilizes two configuration files and a password file. The client portion (GUI front-end) of Project Manager uses client.cfg as the default configuration file. The Server portion of Project Manager uses Server.cfg as its default configuration file and it uses serverpass.cfg as the password file where all the userids and passwords are stored.

The format of these files is simple. In client.cfg, there are two lines, host=127.0.0.1 and port=5001. In server.cfg, there are port=5001 and path=C:\PMServer. The path specifies the server data directory where all the student data are stored.

3.3.2 Configuration Files:

FileNme	Uses/Explanation

Client.cfg	Contains the client(GUI front-end) configuration in name=value pairs.
	Host =127.0.0.1.
	Port=5001.

Server.cfg	Contains the server configuration
	Example
	PATH=G:\PMServer
	Port=5001

Serverpass.cfg	Contains the username and their corresponding passwords. The password is encrypted and this entire file is written using DataOutputStream treating everything as a binary byte. MypassWordCreator.class program is a utility that can be used to create such files.

3.3.3 Index Files:

Addition to this, Project Manager also uses an index files to help it find and track the student projects that are submitted. These index files are named index.dat. They exist in folders named years like 2003. Within year folders there are further folders based on module names like IT-406-JAVAPROGRAMMING, and within these module folders are the term folders like TERM1, TERM2. Index files are located within term folders. Each index will simply contain lines of studentids. The OS file system hierarchy is fully utilized by Project Manager to enable it to track who has submitted in which year and term.

3.4 Program Validations and Processing

This section deals with some of the validation of user input done by the GUI front end as well as how the password mechanism work and how the AI engine generates the signature files and determines hits.

3.4.1 GUI validation and Security

As you see the input and file specifications, most of our user data has little or no restrictions placed on them. This is possible because Swing components are being used. For this initial release, my main is goal is to build a relatively secured program that can perform all the features that I set earlier. Java itself is a secured language, the JVM checks for array out of bounds and doesn’t allow buffer overflow or underflow. The result of this would be a run time exception, which will halt the program before any damage occurs.

I am placing some faith on this mechanism to stop malicious input from users, for this 0.1 release. Subsequent releases could shift the weight of verifying to my own application code. This is not to say that my current version doesn’t do any input checks. In fact it does some very essential input validation.

Based on input specification, the studentid is limited to 12 digits. This is the single important check to prevent malicious attempt that will overwrite critical system files or folders. My program makes use of the OS file hierarchy system for storing of student data and details rather than using a database. It is critical to prevent system path or filename to be entered here.

The use of Swing components like Jcombo boxes which offers a selection list which helps to prevent user from entering unwanted information. JfileChooser limits the user to select either a file or directory. And for the Jtable that I used in the lecturer screen, the TableModel allows me to specify the type of columns. Only two columns are set editable, all other columns are simply for viewing only. The editable column is grade and comments. Grade column is designed to have an integer object and the Jtable will be able to handle the check. And the comment is String, so any editable characters can be entered. Again Jtable and Java handles the checking.

This is one of the most useful features of Java language, the system takes care of many minor details of programming, like memory sizing and data representation. However relying too much on the language itself to handle checks will definitely impact security. I will highlight the possible weakness of my program in later chapter.

3.5 Server Processing

For the server processing of project Manager, there will be a default data directory where all the student projects will be stored. When the server starts up, it will read its configuration file, getting the port number that it listens as well as the path for the data directory to use. If the directory doesn’t exist it will be created. The default name that I use for this directory is PMServer.

When a student submits project, a folder will be created for this student under the data directory. The name of this student folder will be 12-digit studentid that the student has entered. Hence it is very important for the front-end GUI to check this 12 digits input to prevent malicious attempts to overwrite important system folders and files. Within this 12 digit student folder, a module folder will be created to store project that the student is submitting.

Besides creating these data folders, the server also needs an index. So that again makes use of the OS file hierarchy system., The Server would get the data and time which the project is submitted. This date is actually entered when a student connects to the server. Hence the student can’t cheat on the project submission date by modifying the system clock from which PC he is submitting. When student submits a project, it would send the time back to the user.

The server would extract 4-digit year from this timestamp and use it to create a year folder under the top-level data folder. Then it would create a module folder under this year folder based on the module for which the student is submitting. Within the module folder, a Term folder would be created based on the Term the student has selected. Within this Term folder, there would be an index file called index.dat. This will holds the information such as studentid, module, Term and year. This allows the server to keep track of the time and date on which the student submits the project.

The actual project details are stored in the module folder of the particular student folder. The index.dat file in this module folder contains the various fields, which the student has entered during project submission.

I understand it sounds a bit confusing. Please do not confuse between the student index file and server index file. The student index file simply stores students project details for the module the student has submitted project. The server for finding and locating student projects uses the server index file. The server would also create grade file that stores the grade and comments that the lecturer has sent. It will be in the same folder as the student’s index file. An example would be

[BaseServerDataFolder] \ [StudentId] \ [ModuleName] \

index.dat

and

[BaseServerDataFolder] \ [StudentId] \ [ModuleName] \

grade.dat

I hope this sums up how the OS file system hierarchy is used.

3.6 Password Encryption Scheme

The userid and password encryption scheme that I used can be broken down into two sections. One is the secured storage of userid and password file. Second is the transmission of secured userid and password through network. The linux and Unix System influences the first section. The second is influenced by Yahoo.com.

3.6.1 Password and userid File Storage

In Linux, the userid and password are stored in /etc/password file. These files are secured and only can be read and written by the root user. Modern Linux and Unix offers additional password protection scheme called “Shadow Password” Which I am not going to go in detail. In the /etc/password file, the userid is plainly visible, but the password is encrypted. This is what I would do for my password file. Also the server should be running in an operating system that offers file and directory level security. This will allow access permissions to be set on the server password file, providing added security. But for demonstration purpose, Windows 98/95 would be sufficient. Here I have chosen Message Digest 5 as the encryption mechanism for passwords.

Message digest 5 simply processes an input stream of bytes (can be text or binary) and generates a unique 16-byte signature (digest) for the given input. It is believed that there are no two inputs with the same digest (much like our finger prints, no two human having the same prints). Another characteristics md5 is that given a digest, it is not possible to know what input generated the digest. The meaning of this is we can’t reverse the md5 process on a given digest and get the input. MD5 is one way hashing code.

This enables it to encrypt a given text or password and generate unique digest that can’t be reversed back to the original text or password. So only the original user knows what password it is. MD5 is widely used in the open source community as a checksum for the source files and binary packages that are distributed.

Java 1.4 has a security package, Java.Security which contains a message digest class that implements MD5. I am using this message digest class, request a provider for MD5 and then uses the requested MD5 object to do encryption.

For userid and password storage, they are stored as binary bytes using a DataOutputStream. The format is user=encryptedpassword. One such entry per line. I have written a Java utility, MyPasswordCreator which can create such a password file.

The password portion will be of gibberish of characters. The plain text password is first encrypted with MD5 to generate a first digest. This first digest (16 bytes) is then appended to username and MD5 encrypts the resulting bytes again. This final output is stored as password portion.

3.6.2 Password and userid transmission

This section deals with the transmission of userid and password through the network. Project manager is a client/Server model and the information need to travel through a network, which is inherent.

For demonstration, I am going to use a stand alone PC. I can simply use the local loop-back and run both the server and client locally. They still communicate through sockets, like what they will do across an actual network. It uses socket locally as well as within a network for graphical display.

Yahoo.com influenced my userid and password mechanism. Normally when log into Yahoo account, Yahoo uses a JavaScript MD5 implementation to encrypt password before sending it through the network. No plain text transmission is allowed. I came to know about this mechanism when I was teaching the module html and JavaScript (WL1)

Yahoo did not create the JavaScript MD5 implementation, rather it was written by a British youth who made his script available (WL2).

The yahoo server will generate a random number and embed it within the password form at its login page when a user requests for a page via a browser. After the user keyed in his id and password, and hit the submit button, several things happen. Firstly, there will be a browser compatibility check. If this passes, then the JavaScript MD5 is invoked. It will take the password and message digest to generate 16 bytes digest. This digest joined to the random number and generate new digest.

This is the first level of security, no hackers will be able to infer the password from the digest unless they have limitless computing power at their disposal to try a brute force cracking.

I did it slightly different way from the Yahoo model. But basically the idea is the same. The following code taken from ClientPass shows the encryption process.

```
result = Encrypt(bpass);
  temp = merge(buser, result);
  result = Encrypt(temp);
  temp = merge(result, getRandbyte());
  result = Encrypt (temp);
```

result is a byte array that will be the final digest sent across the network, buser is a byte array contains username or userid, bpass is the byte array contains the password. GetRandbyte will retrieve an array of 64 bytes of random data. Merge is a join method for joining two byte arrays together to give a single byte array. The password is encrypted first and joined to the username and they are encrypted and this is joined to the random bytes and encrypted to give the final digest. This far more secured than the yahoo.com method as the username, just a stream of bytes that is different each time.

Crawler and AI engine

Plagiarism, what does it mean exactly. Here is the definition.

The act of taking the writings of another person and passing them of as one’s own. The fraudulence is closely related to forgery and piracy – practices generally in violation of copyright laws.

The above definition applies to writings and violations of copyright, what about software sources, are these considered writings? They are definitely a form of expression and protected by copyright laws. The software sources can also be plagiarized.

In software there is a saying “ why reinvent the wheel”, the actual meaning of this is code reusability. When we look at stdlib that we are using today, we all use scanf(), printf() etc. This is use of other’s work. But it is not plagiarism. Object Oriented language provides a greater challenge, there are many prebuilt classes and libraries, with much data and code abstraction, indeed it is very difficult to identify which is original. In education and teaching, it could even be harder. Normally how the students copy code? The stupidest method is just to simply grab all the sources without modifications and call it their own. A more intelligent approach is to get source, and modify some of the parameters like the text message, data and some information to suite their purpose. The above two methods does not require much knowledge about programming language. So if we strip away the white spaces, strip away the parameters, data and comments, the digest of this would be the same as original.

The difficulty is when the copier knows the programming language and is able to modify not just parameters but also methods and classes. Here comes our AI engine. Now we will how it works.

In Java, package is also related to directory, and class can be related to file names. For example if the class contain a method that has the same name as another method in some other class of other student. In some other cases no same method, but parameters are the same. It indicates a strong possibility of copying.

The class, which is used to find such similarities, is Crawler. It search all the different folders of each student, looking at the sources and generating a signature file called crawler.dat. To make it simple, I took only class and method signature. I have used two patterns for matching, one for class and the other for method. The code snippets is from Crawler class and shows the regular expressions patterns for the class and method.

```
    private String classpat = "class\\s+([a-zA-Z0-9]+)\\s";  //pattern for class
```

```
private String method ="([_a-zA-Z\\$]+[_a-zA-Z0-9\\$]*)\\s*\\(.*\\)\\s*\\{"; //pattern for method
```

The pattern for searching for class is any string that contains the word “class” followed by at least one white space or more and then any alphanumeric characters one or more times. I found that this pattern allows to pick up classes easily.

Next is pattern for matching method. Any alphabets, underscore, dollar sign followed by any alphanumeric or underscore or dollar sign zero or more times followed by a white space zero or more times followed by an open bracket”(“ and any characters in between followed by closed bracket”)”, followed by a white space zero or more times, followed by curly bracket “{“.

While the first class pattern is able to pick up classes nicely, but this second pattern for method doesn’t pick up method as clean as class. The reason is things like (IOException e) {, while(true) }, System.out.println(“Kdofa{, etc.. do appear sometimes. However since I am using both patterns together, class match followed by method match forms a single line , but as an example I have included some from each class to give a mini view or what Crawler.dat is really about.

```
PassWordCreator.java      Class     PassWordCreator
PassWordCreator.java      Class     to
PassWordCreator.java      Method    PassWordCreator
PassWordCreator.java      Method    catch
PassWordCreator.java     Method     catch
MyTableModel.java   Class   MyTableModel
MyTableModel.java   Method         MyTableModel
MyTableModel.java   Method         MyTableModel
MyTableModel.java   Method         for
MyTableModel.java   Method         getColumnCount
MyTableModel.java   Method         getRowCount
MyTableModel.java   Method         getColumnName
StudentScreen.java    Class   StudAction
StudentScreen.java    Method         StudentScreen
StudentScreen.java    Method         actionPerformed
StudentScreen.java    Method         if
StudentScreen.java    Method         if
SubmitServer.java     Method         submitsourcefile
SubmitServer.java     Method         for
SubmitServer.java     Method         resetcon
SubmitServer.java     Method         submitprojectfile
SubmitServer.java     Method         for
SubmitServer.java     Method         sendBinFile
SubmitServer.java     Method         while
SubmitServer.java     Method         if
SubmitServer.java     Method         while
SubmitServer.java     Method
LecturerScreen.java   Method         browseSave
LecturerScreen.java   Method         if
LecturerScreen.java   Method         showWarning
LecturerScreen.java   Method         valueChanged
LecturerScreen.java   Method         if
```

This is the unique signature of some sources of project manager. It is highly unlikely that someone else could have the same exact signature file unless they copy project manager sources exactly.

After crawler crawls through all the source directories generating crawler.dat for each set of students sources, it will then start comparing crawler.dat files that belongs to the same module. In this case, it will compare Project Manager signature file with other signature files from other projects in Java Programming module. In this way it detects hits (similar lines). Suppose we have a crawler.dat A, and second crawler file B, The first line of A is read and it is compared to all the lines in B. Once it finds a match, a counter is incremented and the second line of A is read. This process is repeated until all the line in A has been compared. The counter would hold the number of hits. This value divide by the total number of lines in A will yield the percentage of A’s signature that is similar with B’s. The percentage result is stored in ai.dat and also uploaded into grade.dat. Furthermore, the directory string of B will be stored into the comments of grade.dat. This allows the lecturer to know both the percentage of similarity as well as with whom it is similar.

How well does this heuristic work? Frankly I don’t really know. It takes lot of testing with the large sample of diverse sources before knowing the result. I find it works moderately well. For blatant and outright copying, this method should be able to pick them out easily.

4. Coding and Testing

4.1 Coding

As I have stated in my Introduction, I have done the coding by using Java Jdk 1.4.1. The main reason for using Java is I am more familiar and comfortable with Java other than any other language. And also I was able to integrate AI with Java. I have done the Design and coding concurrently. The language is chosen based on the following characteristics.

Ease of design to code translation

Compiler efficiency

Source code portability

Maintainability.

Although there are many “new and better programming languages, sometimes it could also be better to choose a “weaker” (old) language that has solid documentation and support software, is familiar to everyone on the software development team and has been successfully applied in the past. It is true in my case since I have done a small project on Java for my CSM1020 module that gave me the confidence to use Java.

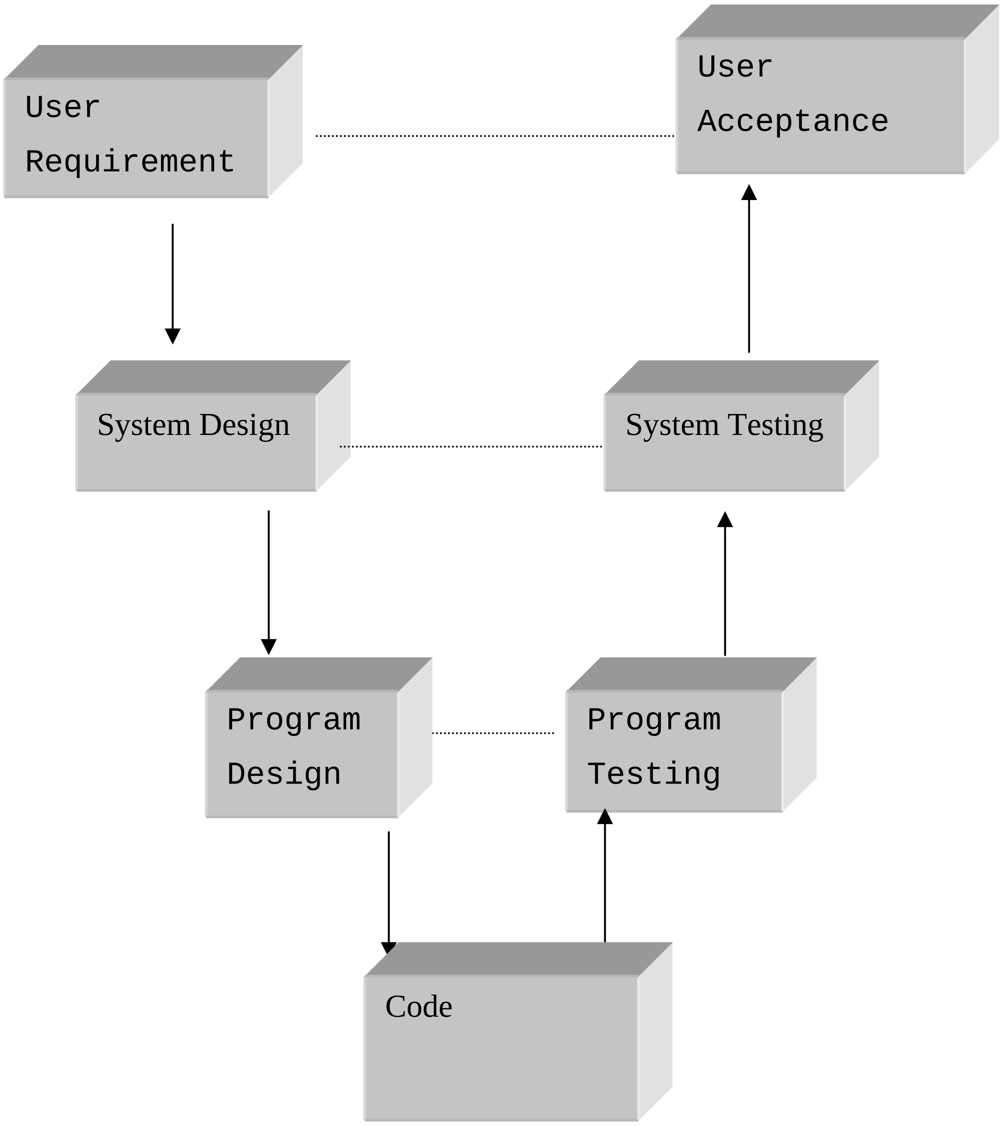
4.2 Testing

Testing the artefact of systems development, whether it is hardware or software, is always an important activity, however it is often squeezed to the end of the project due to the enforced pressures of time upon a project (Cheffey et al, 2003). It is a renowned fact that no system is built without containing few bugs but if the identification of these errors goes unnoticed then the chances of successful project will have been severely hindered (Jordan et al, 1990)

As I am aware of the importance of testing the artefact from the very start of the project and one of the main reasons for adapting the Life Cycle Model approach. Owing to previous development experience whilst working for small project, I am very much accustomed to the approach of integrated testing throughout the software development process. In addition to my experience, the principle of the adapted methodology states that testing should be integrated throughout the development life cycle.

Bearing this point in mind, the majority of the testing has been already carried out in the iterative design and build phase of the project. When writing each class and method, the developer tested to see that the correct results were being obtained. For example the class used to detect plagiarism and write the comment into grade.dat was tested to ensure that the similarities are detected and it is saved into grade.dat.

Having stated that the majority of testing has already been accomplished by integrating it throughout the life cycle, there is still some final testing to be carried out. By looking at the V-Model for systems development (figure –source: Adapted from Life Cycle Models, Allan 2003b), it can be seen that having adopted the integrated testing approach the developer has already considered the majority of testing that takes place within the system, with the exception of User Acceptance Testing.



The final stage of user acceptance testing is where the final artefact is tested in the operating environment where it will eventually be used (Hoffer et al, 2002). Owing to the fact that the users were involved throughout the development, the developer had already been testing the artefact using simulated test data(Alpha testing) and was confident that the system was producing the correct and desired results. So the final stage is to employ Beta testing strategy, where the members of Project Manger used the system in their working environment.

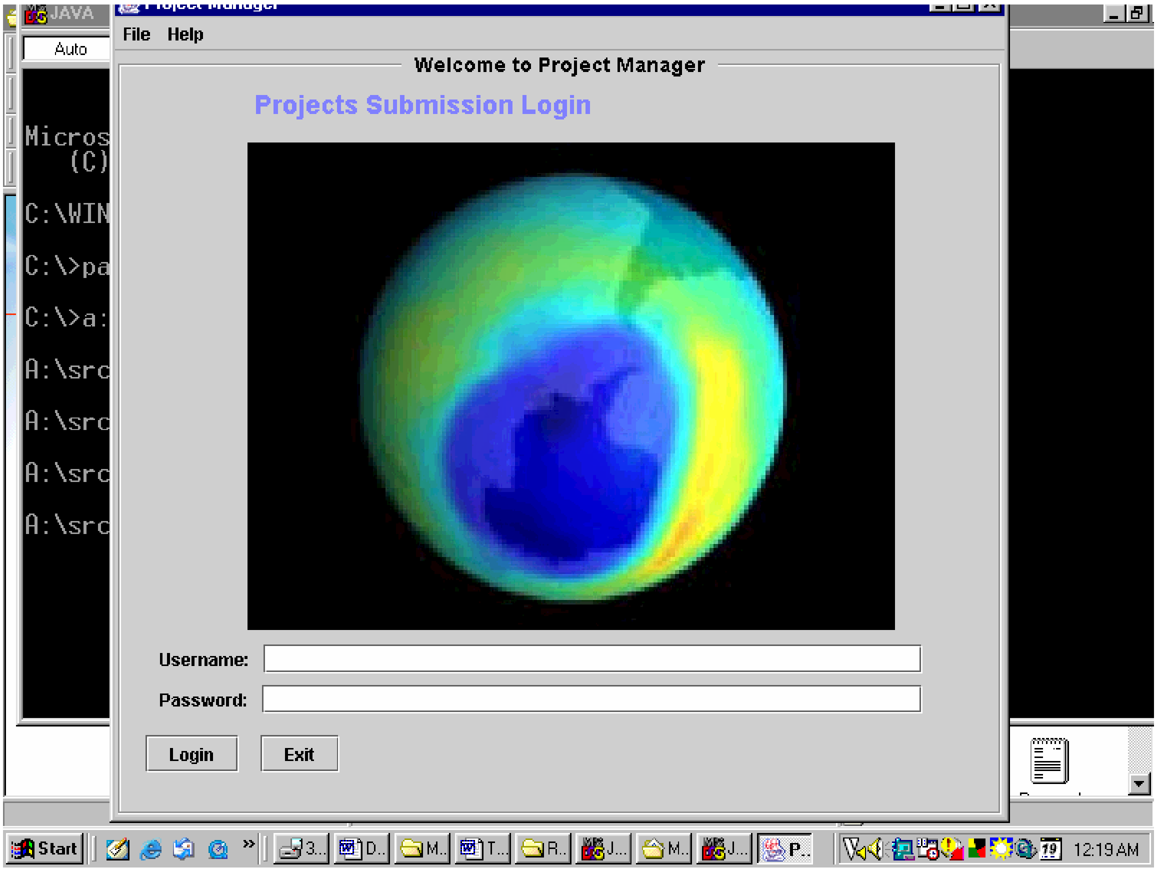
For testing I have used AMD K6 III 500Mhz pc running Windows 98 second edition. Although my main testing was using Windows 98, Project Manager should also be able to run effectively under Linux or Unix. In fact project Manager should be able to run pretty much the same on any machines that supports the Sun JRE 1.4.

Test Case	Test Plan
1.	Test That the Server is able to read its configuration server.cfg properly
2.	Test that the client is able to read its configuration file client.cfg properly
3.	Test that the userid and password are sent as a different random stream of bytes for each connection.
4.	Test that when wrong userid and password is entered, the login screen will prompt the user and exits.
5.	Test that when the correct userid and password is entered, the student can proceed to the student screen
6.	Test that when the correct lecturer id and password is entered, the lecturer can proceed to the lecturer screen.
7.	Test that the Exit on the menu bar is working.
8.	Test that the help on the menu bar is working.
9.	Test that the about on the menu bar is working.
10.	Student screen: Test that when essential fields are not filled in, a error prompt will come up.
11.	Student Screen: Test that when a student enters illegal characters for StudentID, a error prompt will come up.
12.	Student Screen: Test that when the student selects the term and module, the right data is sent to the Server.
13.	Student Screen: Check that when the student clicks on the browse source directory button, the JFileChooser dialog for selecting directory will pop up.
14.	Student Screen: Check that when a student clicks on the browse project documentation button, The JfileChooser for selecting a single file will come up.
15	Student Screen: Check that when the submit button is clicked, the project details source files and documentation will be sent to the Server.
16.	Student Screen: test that after submission, a dialog box will pop up saying that submission is successful.
17.	Student Screen: Test that when the reset button is clicked, all the fields will be emptied.
18.	Lecturer screen: When the lecturer clicks on update, the

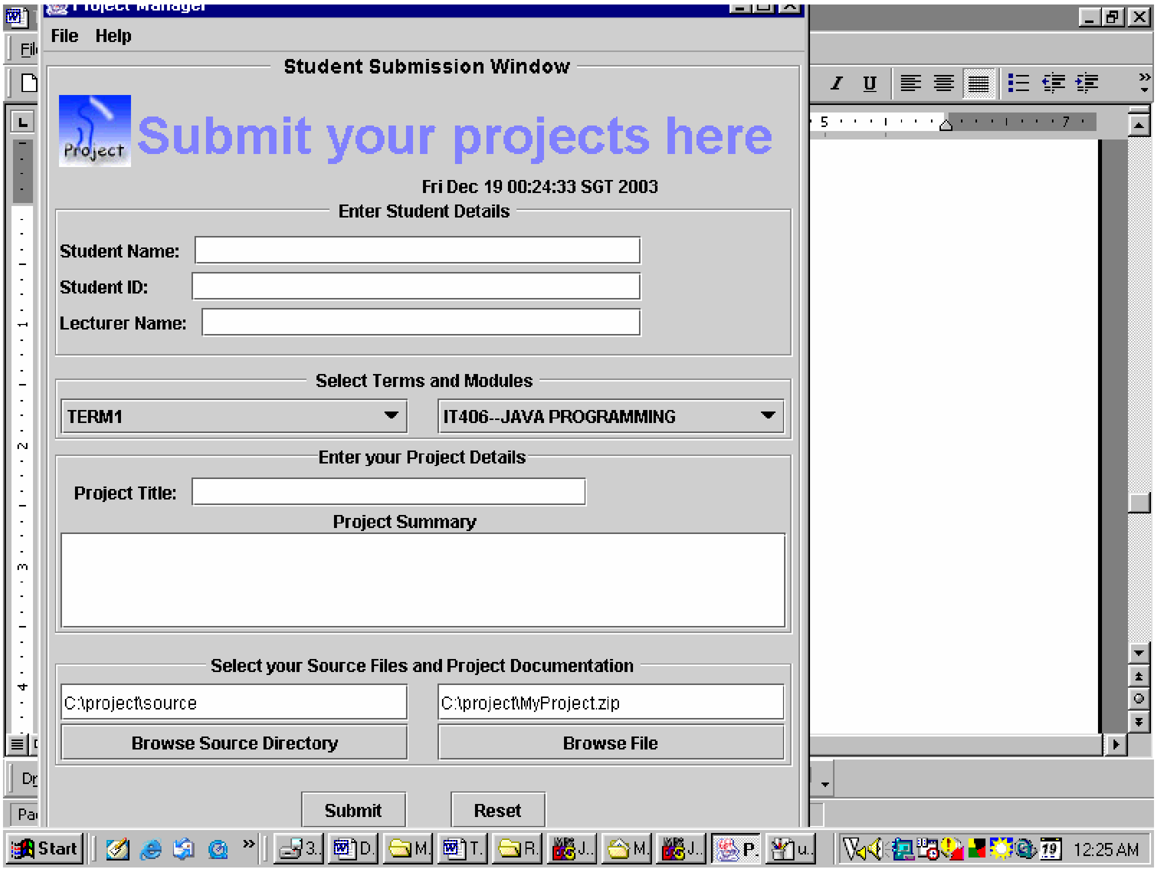
	application will fetch the project details from the server and update the JTable.
19.	Lecturer Screen: Test to prompt a message when there is no match of the selected criteria.
20.	Lecturer screen: Test that the JfileChooser will pop up with the message asking for a place to store the student projects when a lecturer selects a particular project to be retrieved.
21.	Lecturer Screen: Test that the lecturer can edit the grade column and the comments.
22.	Lecturer Screen: Test that when the Lecturer click on the set grade button, the student's grade will be updated on the server.
23.	Test that when the Lecturer clicks on the analyse button, AI crawler is started on the Server
24.	Lecturer Screen: Test that a pop up message will be appeared saying to wait and also informs that only one analysis can be made per session.
25.	Lecturer Screen: After analysis, when the lecturer clicks on update again, the comments column will show the analysis result.

The main test cases are shown below. The detailed test cases can be referred appendix 7.

Login Screen



Student Screen



Student Submission Window

Submit your projects here

Fri Dec 19 00:24:33 SGT 2003

Enter Student Details

Student Name:

Student ID:

Lecturer Name:

Select Terms and Modules

TERM1

IT406--JAVA PROGRAMMING

Enter your Project Details

Project Title:

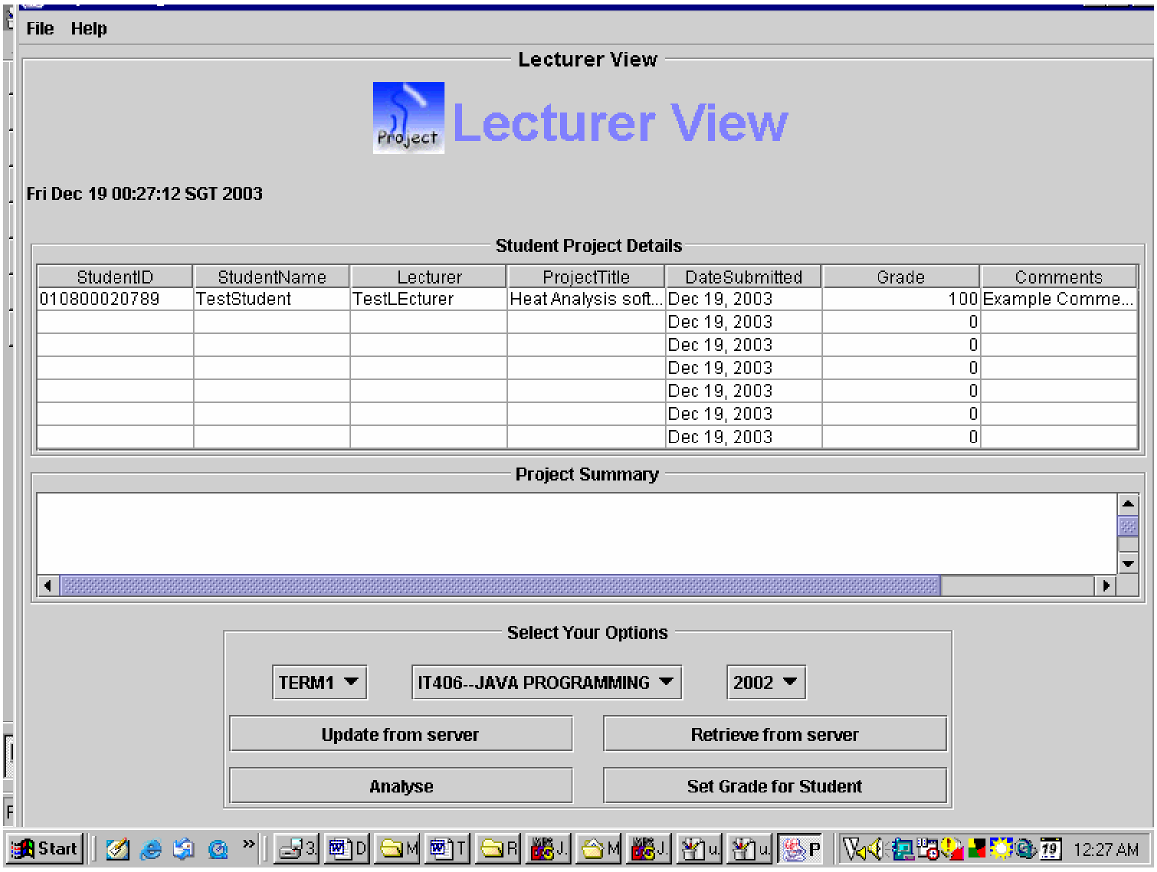
Project Summary

Select your Source Files and Project Documentation

C:\project\source

C:\project\MyProject.zip

Lecturer Screen



Fri Dec 19 00:27:12 SGT 2003

Student Project Details

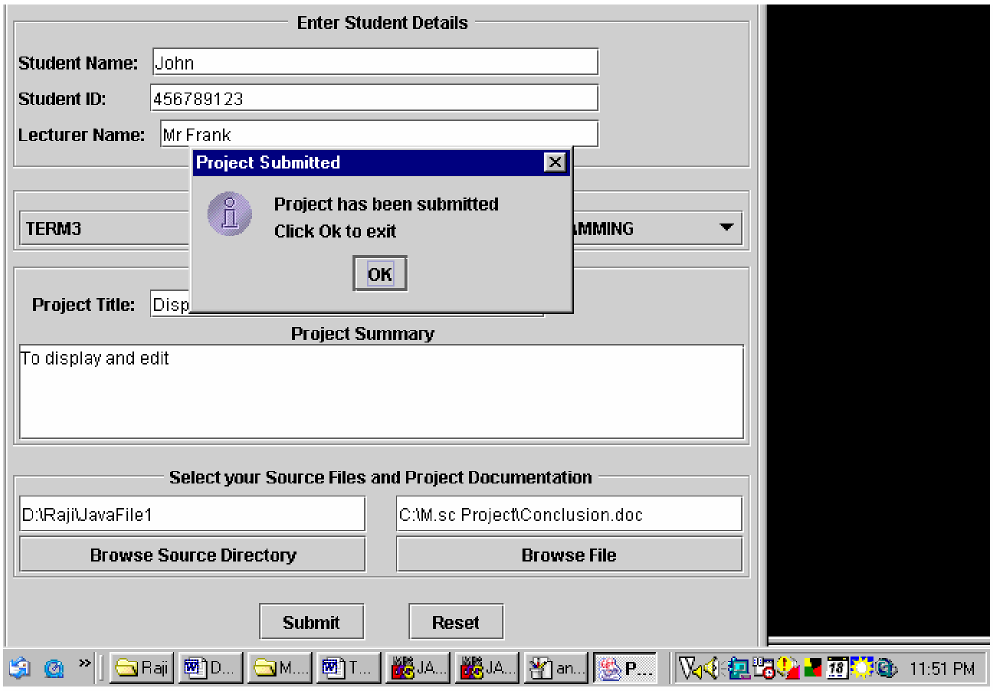
StudentID	StudentName	Lecturer	ProjectTitle	DateSubmitted	Grade	Comments
010800020789	TestStudent	TestLEcturer	Heat Analysis soft...	Dec 19, 2003	100	Example Comme...
				Dec 19, 2003	0	
				Dec 19, 2003	0	
				Dec 19, 2003	0	
				Dec 19, 2003	0	
				Dec 19, 2003	0	
				Dec 19, 2003	0	

Project Summary

Select Your Options

TERM1 ▼ IT406--JAVA PROGRAMMING ▼ 2002 ▼

Student’s project submission



Enter Student Details

Student Name: John

Student ID: 456789123

Lecturer Name: Mr Frank

TERM3

MMING

Project Title: Disp

Project Summary

To display and edit

Select your Source Files and Project Documentation

D:\Raji\JavaFile1

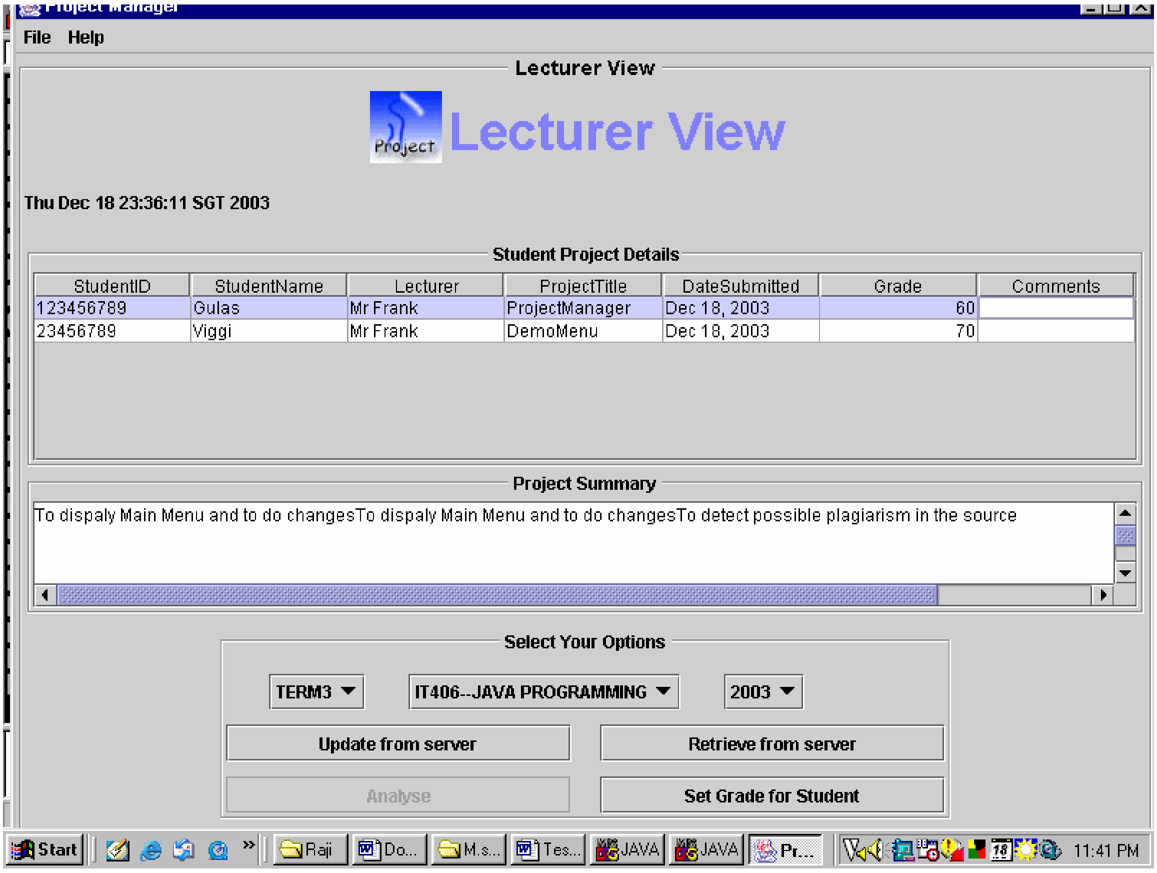
C:\M.sc Project\Conclusion.doc

Project Submitted

Project has been submitted

Click Ok to exit

Lecturer View project



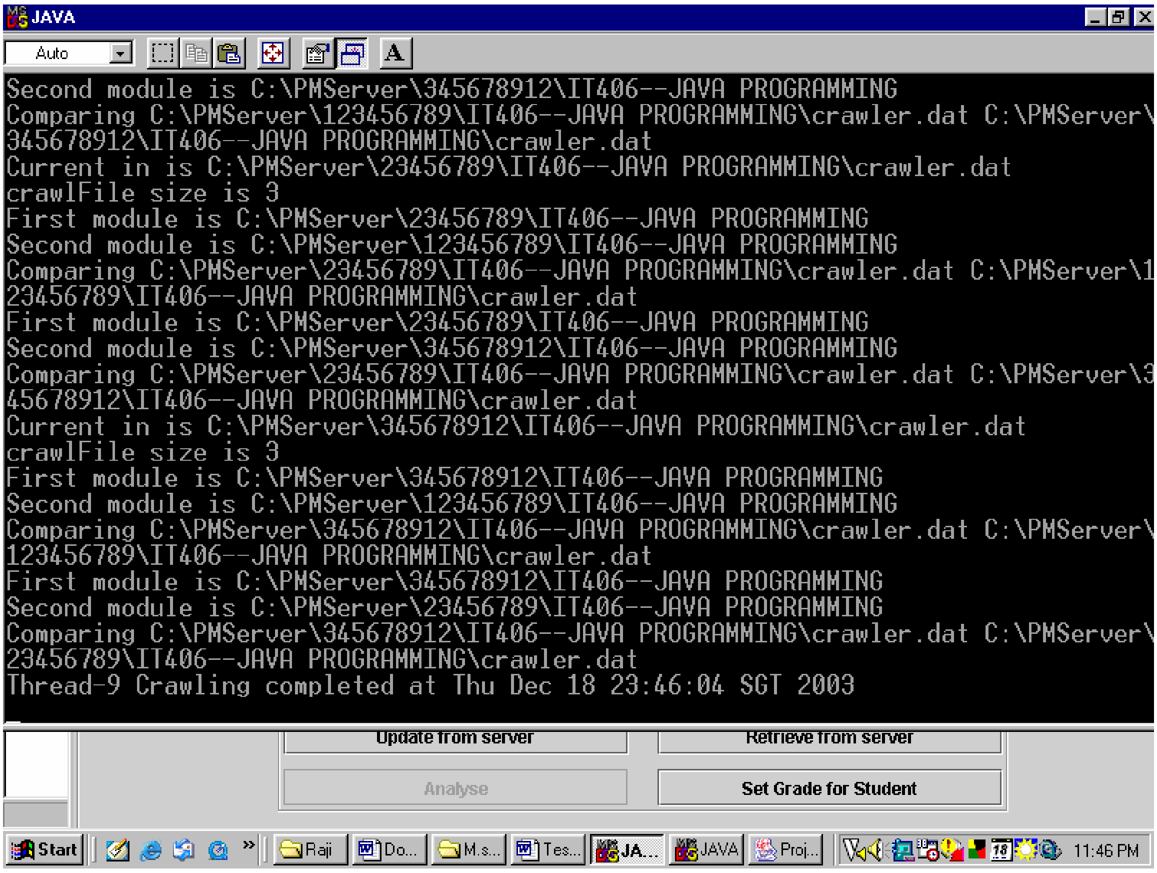
Thu Dec 18 23:36:11 SGT 2003

StudentID	StudentName	Lecturer	ProjectTitle	DateSubmitted	Grade	Comments
123456789	Gulas	Mr Frank	ProjectManager	Dec 18, 2003	60	
23456789	Viggi	Mr Frank	DemoMenu	Dec 18, 2003	70	

To dispaly Main Menu and to do changesTo dispaly Main Menu and to do changesTo detect possible plagiarism in the source

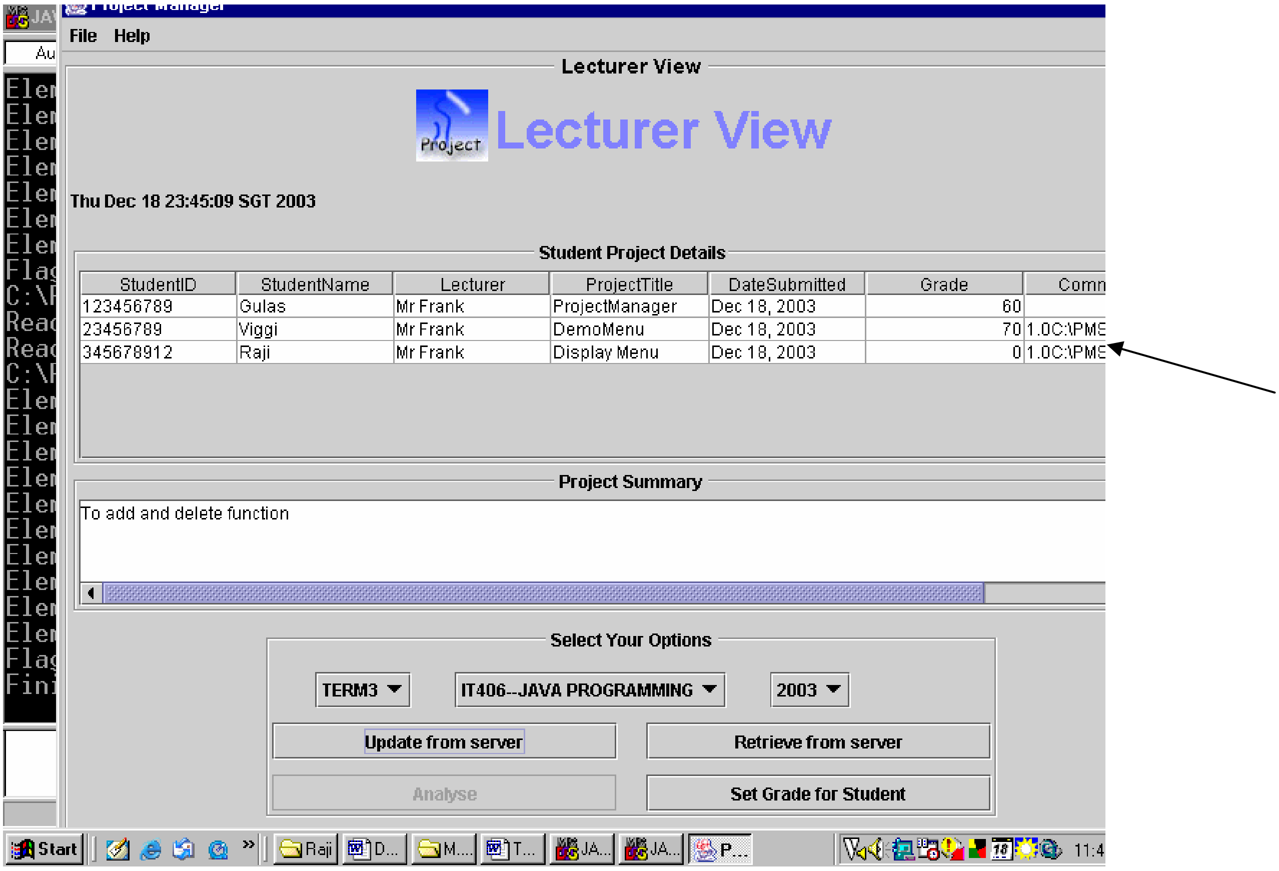
TERM3 | IT406--JAVA PROGRAMMING | 2003

Once Analyse button is pressed



```
Second module is C:\PMServer\345678912\IT406--JAVA PROGRAMMING
Comparing C:\PMServer\123456789\IT406--JAVA PROGRAMMING\crawler.dat C:\PMServer\
345678912\IT406--JAVA PROGRAMMING\crawler.dat
Current in is C:\PMServer\23456789\IT406--JAVA PROGRAMMING\crawler.dat
crawlFile size is 3
First module is C:\PMServer\23456789\IT406--JAVA PROGRAMMING
Second module is C:\PMServer\123456789\IT406--JAVA PROGRAMMING
Comparing C:\PMServer\23456789\IT406--JAVA PROGRAMMING\crawler.dat C:\PMServer\1
23456789\IT406--JAVA PROGRAMMING\crawler.dat
First module is C:\PMServer\23456789\IT406--JAVA PROGRAMMING
Second module is C:\PMServer\345678912\IT406--JAVA PROGRAMMING
Comparing C:\PMServer\23456789\IT406--JAVA PROGRAMMING\crawler.dat C:\PMServer\3
45678912\IT406--JAVA PROGRAMMING\crawler.dat
Current in is C:\PMServer\345678912\IT406--JAVA PROGRAMMING\crawler.dat
crawlFile size is 3
First module is C:\PMServer\345678912\IT406--JAVA PROGRAMMING
Second module is C:\PMServer\123456789\IT406--JAVA PROGRAMMING
Comparing C:\PMServer\345678912\IT406--JAVA PROGRAMMING\crawler.dat C:\PMServer\
123456789\IT406--JAVA PROGRAMMING\crawler.dat
First module is C:\PMServer\345678912\IT406--JAVA PROGRAMMING
Second module is C:\PMServer\23456789\IT406--JAVA PROGRAMMING
Comparing C:\PMServer\345678912\IT406--JAVA PROGRAMMING\crawler.dat C:\PMServer\
23456789\IT406--JAVA PROGRAMMING\crawler.dat
Thread-9 Crawling completed at Thu Dec 18 23:46:04 SGT 2003
_
```

View comments



Lecturer View

Thu Dec 18 23:45:09 SGT 2003

Student Project Details

StudentID	StudentName	Lecturer	ProjectTitle	DateSubmitted	Grade	Comn
123456789	Gulas	Mr Frank	ProjectManager	Dec 18, 2003	60	
23456789	Viggi	Mr Frank	DemoMenu	Dec 18, 2003	70	1.0C:\PMS
345678912	Raji	Mr Frank	Display Menu	Dec 18, 2003	0	1.0C:\PMS

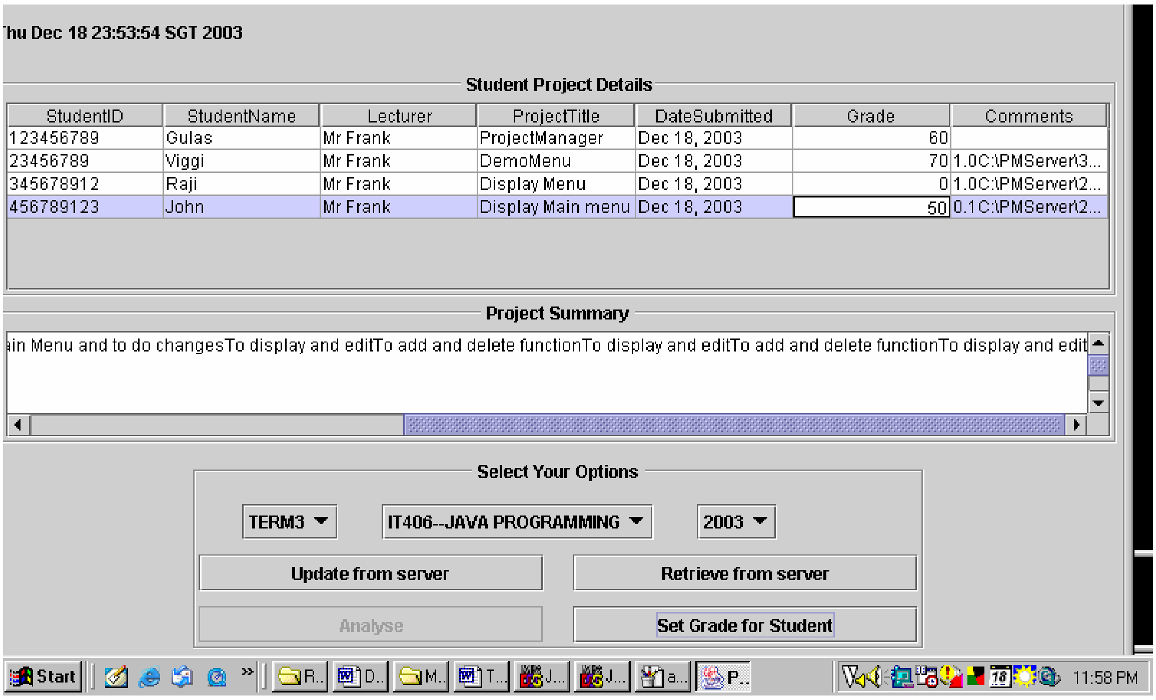
Project Summary

To add and delete function

Select Your Options

TERM3 · IT406--JAVA PROGRAMMING · 2003

The comments stated 1.0 means it is of 100% similar code. As I have uploaded the same source code for the user Viggi and Raji, it is able to detect the similarities.



'hu Dec 18 23:53:54 SGT 2003

Student Project Details

StudentID	StudentName	Lecturer	ProjectTitle	DateSubmitted	Grade	Comments
123456789	Gulas	Mr Frank	ProjectManager	Dec 18, 2003	60	
23456789	Viggi	Mr Frank	DemoMenu	Dec 18, 2003	70	1.0C:\PMServer\3...
345678912	Raji	Mr Frank	Display Menu	Dec 18, 2003	0	1.0C:\PMServer\2...
456789123	John	Mr Frank	Display Main menu	Dec 18, 2003	50	0.1C:\PMServer\2...

Project Summary

ain Menu and to do changesTo display and editTo add and delete functionTo display and editTo add and delete functionTo display and edit

Select Your Options

TERM3 IT406--JAVA PROGRAMMING 2003

The user John’s code is 10% similar to Viggi, as the developer discussed in the earlier section up to 20% of similarities are acceptable because of code reusability.

The result from the Beta Test scenario were extremely positive (appendix 7), although there were some recommendations and system imperfections reported. Every member of the Project Manager was able to log into the system and able to upload their project.

A negative aspect that came back from the beta testing was that as the number of student increases, it was taking longer time to do the search. For one student approximately it takes 30 seconds to do a search. For a class of 40 students it may take more than an hour. But it is worth spending one hour to detect the similarity of coding. Although the volumes of projects this was something I have considered when designing the system, it was not anticipated that the search would take so long to display results and it is an unfortunate drawback. Still it is much better than the manual search.

5. Evaluation and conclusions

5.1 System Evaluation

This chapter of the report looks into the overall success of the project Manager that has been developed for the submission of projects. To prove the overall success of the final system, the developer has utilized two different evaluation methods, which were

- to evaluate the system against the user requirements, and
- to evaluate the system against the system previously used.

5.1.1 Evaluation against Requirements Specification

From the system analysis that has previously been carried out (Chapter 2) the developer has indicated a list of user requirements that were the required functionality for the new system. To judge whether or not the developer has attained these targets each of the requirements has been evaluated and discussed.

To provide a single repository to hold project submission

The main purpose of this project was to solve the problem of manual storage of projects and to keep track of the students who have submitted their projects, which have been achieved by the developer. By adopting client/server architecture, students are able to submit their project as softcopy.

A GUI front end to enable student to submit projects

The system was not only required with central repository, but also to provide good user Interface. This requirement was achieved by creating a central interface on the main application window that showed the login screen. Its main difficulty lies in the fact that the developer comes from a technical background and has little practical experience in dealing with Java environments. Although Java is one of the module in M.Sc course, GUI concept is totally new to the developer and substantial time has been spent on understanding the concepts.

Access Control facilities to prevent unauthorized access

Following on the previous requirement, this next item of functionality was also achieved. Currently, the default accounts are set as follows

Default Login for Student is username: Student password: password

Default Login for Lecturer is username: Lecturer password: password

By using password creator utility the default password could be changed to any password. But the user name should be Student or Lecturer.

A mini AI engine that allows the system to warn the lecturers of possible plagiarism.

Based on the hit rate the lecturer could conclude the possible plagiarism. For lower figures like 10 to 20 %, it should be reasonable. This is because of the way the AI engine works. As explained in the previous section, the crawler.dat signature could have some common lines such as try { }, catch{} etc.

Non-Functional requirements

Every non-functional requirement that was set in the requirements specification was achieved in the final system. As per requirement, the upload time was reasonable and information was viewable by Lecturers.

From the beta testing that was carried out after the system has been installed, each member of the team agreed that the system was simple and quick to use. The only drawback was the time taken to analyse the projects when the number of project is increased. It allows the lecturer to keep track of the information such as name, id, submission date etc. All the information was stored in a text file, which was created under different userid.

5.1.2 Evaluation against Original System

The original system, or the manual system, that were used to manage project submission, fall a long way short of meeting any of the functionality that is offered by the new system.
The greatest problem with the way in which submission was previously managed was the lack of standardized and centralized approach. In a manual system, all lecturers worked independently and in an unstructured way. The new system that has been developed solves all problems and drawbacks with the previous system and has been built in a scalable fashion for any future enhancement.

5.2 Known bugs and issues not resolved in this release

As we know, no software is perfect and any user manual would be incomplete without warning about the current known bugs and unsolved issues. I shall highlight few possible bugs and security loopholes.
Multiple submissions of projects: when a student submits a project multiple times, the lecturer screen will show multiple rows of the same student. However, when the lecturer retrieves only the latest file would be retrieved.

Overwriting other students project: A malicious student could easily overwrite another students project if he or she knows the student id. This is a major security loophole, which needs to be solved for any real system.

For this release my goal was to demonstrate a working prototype with all the features I have stated.

5.3 Strengths and weaknesses of the system

5.3.1 Strengths

By using a Client/Server model, Project manager allows a centralized method of organizing and storing student projects. Another advantage of the system is password encryption scheme. Rather than hard coding userids and password into the program code, a separate password file is used. And the passwords in this file were encrypted.

The use of configuration file for both client and server is another strength of project manager.

Finally, Project Manger is designed as modular base. For instance, the student screen functions could be changed without affecting the lecturer screen. Such modular design allows parts to be changed easily and new features to be added. It is also easy to debug and maintain.

5.3.2 Weaknesses

As highlighted earlier, the bugs identified in the previous section can definitely be considered as weakness of Project Manager. The other aspects of Project Manager is, when I strive to build a component based and an Object Oriented design that can enable code reusability, the developer admits that some parts of the coding were really quick hacks to get the application going.

Furthermore the communication protocol between the server and the client was delicate and it was not perfect in some places. Better planning and clean separation of communication protocol from the components would provide a better design. Project Manager utilizes the Operating System hierarchy to organize and store student's projects instead of using a database. The weakness is that there is no concurrency protection in this release. Also there were insufficient checks for user identity.

5.4 The development method

It would have been better to use Visual Basic than Java and instead of using text files for storage to have used database. Although the back end is non-transparent to the users, it could have been easier to manage and control data if it were database oriented. But the Visual Basic is very much new to me and the developer I am familiar with Java and was able to achieve the required specification.

As I have stated earlier, each centre has its own server for storage. Currently, the system was implemented in one centre as Pilot approach. If it is successful then it will be implemented in the remaining centres. Meanwhile the bugs and security loopholes will be rectified before the release of second version

References

1. AVISON, D AND FITZGERALD, G. (2003). Information Systems Development: Methodologies, Techniques and Tools. 3rd ed. McGraw Hill.

2. BENNETT, S, MCROBB, S. and FARMER, R(1999). Object Oriented Systems Analysis and Design using UML. McGraw Hill.

3. BRUCE ECKEL Thinking in Java 2 http://www.mindview.net/Books

4. CHEFFEY, D., BOCIJ, P., GREASLEY, A. and HICKIE, S. (2003). Business Information Systems: Technology, Development and Management for the e-business. 2nd ed.Prentice Hall.

5. DON YEATES, JAMES GDLE, MAURA SHIELDS, DAVID HELMY. System Analysis and Design. Prentice Hall, 1994.

6. GRIFFITHS, G. (1998). The essence of structured Systems Analysis Techniques. Prentice Hall.

7. HOFFER, J. A., GEORGE, J.F. and VALACICH, J.S.(2002). Modern System Analysis &Design. 3rd ed. Prentice Hall.

8. IVOR HORTON, (2000). Beginning Java 2 . Work Press

9. JOSEPH P.BIGUS and JENNIFER BIGUS (2001). Constructing intelligent agents with Java

10. PRESSMAN, R.S(2000). Software Engineering A practitioners approach. 5th ed McGraw Hill
11. WEAVER, P.L., LAMBROU, N. and WALKLEY M. (1998). Practical SSADM Version 4+ - A complete Tutorial guide. 2nd ed. Pitman Publishing.

Web References

www.pajhome.org.uk/crypt/md5- Concepts in encryption

http://www-106.ibm.com/developerworks/java - Java Socket programming

www.javasoft.com- Official Sun Microsystems Java Site.

Appendix

Appendix1 – Sample Questions
Questionnaires Form
Name: ___________________

Class: ___________________

Date: ___________________

Questionnaires (Lecturers only)

1. How would you grade your IT skills? (Software)	Not Good	Can Do	Good	Very Good
2. Do you find current Project submission system taxing?	Very Taxing	Taxing	O.k.	No
What do you dislike most about the current system?	Nothing	Time consuming	Problem to keep track of the project	Conflict in results
How comfortable are you about the new idea of online submission?	Not comfortable	O.K	Would like to try	Very comfortable
Are you prepared to have online Submission system?	NO	Maybe	Would Like to try	Yes, Definitely
What features would you like to have in the new system?	Central Repository	Check for plagiarism	Both	Nothing

Please put you thoughts on having online Project submission system

Questionnaire (Students)

1. How do you grade your IT skill?	Not Good	Can do	Good	Very Good
2. Will you feel comfortable to have online project submission system	Not Comfortable	O.K	Would like to try	Yes, Definitely
What features would you like to have in the new system	Plagiarism check	Central repository	Both	Nothing

Appendix 2

Design Tools considered

2.1 Logic flow chart

Flow charts are no longer considered as modern technology. Flow charts focus mostly on decisions, a special type of process that now appears in DFD and object diagrams. A summary of flow charting technique is as follows.

1. Functions, or processes are represented by rectangles.
2. Decisions are represented by diamonds
3. Inputs are represented by parallelograms
4. Outputs are represented by a hardcopy symbol (a rectangle symbol with a wavy bottom edge).

2.2 Nassi-Sceneiderman Diagram

It is a modern alternative to flow charts.

1. Can be drawn using text and line.
2. Shows process by series, by selection or iteration
3. More structured than flow charting

2.3 E-R Diagram

It is used to model the entities that a computer system records information about, and the relationships between those entities. The evolution of ERD typically progresses either from scratch or it is reverse engineered from existing database schema. It supports various stages of development, beginning with support various stages of development, beginning with a user readable form that allows validation of design, and is used by developers to validate a design at summary levels.

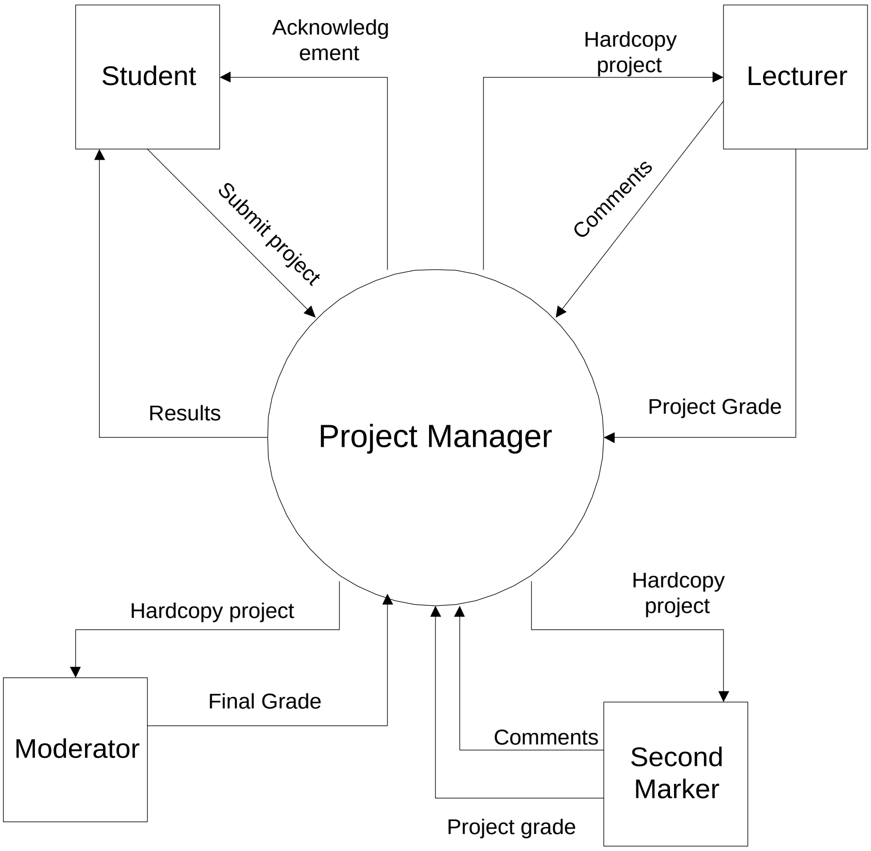
Many developers and CASE tools still use Bachman's crowfoot notation to indicate the cardinality of relationship. The relationship type is written on or near the line that represents a relationship.

2.4 Data Flow Diagram

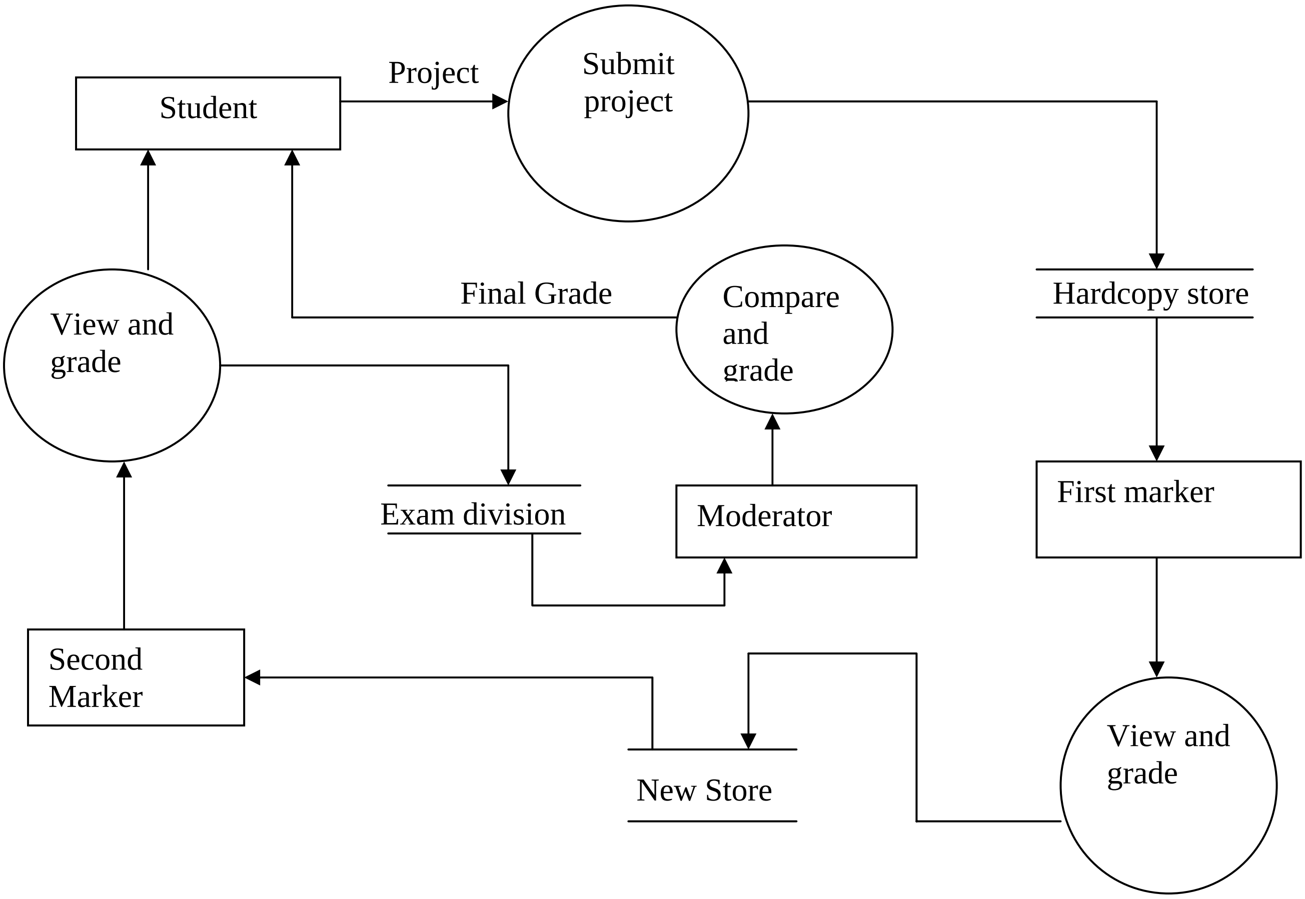
DFD assists in the functional decomposition process. There are different notations and standards are available. For my project, I am using Yourdon notation and standard.

The attributes of Yourdon notation is as follows

1. Two parallel, horizontal lines represent a data store.
2. Processes are represented by a circle
3. Rectangular or square boxes to represent Input.
4. Directed arrow to represent data flow.


Student
Acknowledg ement
Hardcopy project
Lecturer
Submit project
Comments
Results
Project Manager
Project Grade
Hardcopy project
Hardcopy project
Final Grade
Moderator
Comments
Second Marker
Project grade

Level0 DFD


Project
Submit project
Student
Final Grade
Compare and grade
Hardcopy store
View and grade
Exam division
Moderator
First marker
Second Marker
New Store
View and grade

Level1 DFD

Appendix 3

Requirement Catalogue

ID	Description
01	Getting connected to Server
02	Getting acknowledgement from Server
03	Password checking
04	Create login Screen for Student and Lecturer
05	Allow submission of projects for students
06	Validate all field
07	Getting acknowledgement for project submission
08	Validate Reset Field
09	Allow Lecturer to view projects
10	Validation on Lecturer Screen
11	Allow Lecturer to edit grade
12	Allow Lecturer to analyze the projects
13	Pop up screen to indicate analyze is complete
14	Allow Lecturer to update the status

Appendix 4

Data Dictionary

4.1 Student Input Specifications

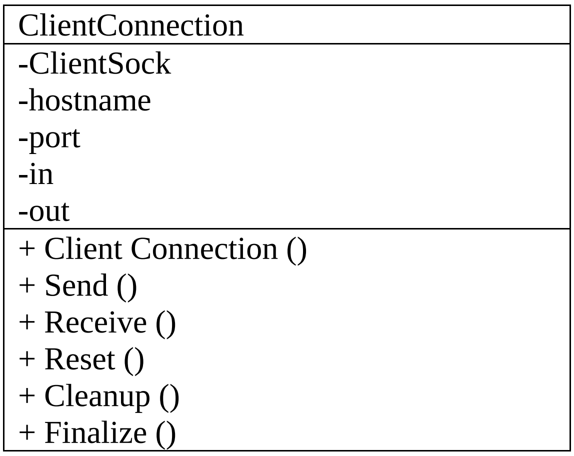
Field	Format
Student ID	AlphaNumeric
StudentName	Alphanumeric(no length limit)
LecturerName	Alphanumeric(no length limit)
ProjectTitle	Alphanumeric(no length limit)
ProjectSummary	Alphanumeric(no length limit)Generate examination confirmation list
Term	Standard selection (eg. Term1, term2, Term3,Tterm4.
Module	Standard Selection that is fixed(eg.IT406—Java Programming, IT413---Oracle)
ProjectFile	A single project documentation file in Binary format(No size limit).
Project Sources	All the source files in a source directory inclusive of all directories relative to this ba directory.

4.2 Lecturer Input Specifications

Field	Format
Grade	Integer
Comments	Alphanumeric (Unlimited length)

Appendix 5

Class Diagram



clientConnection class to enable the client to get a socket to link to the server

Lect Get Student
- Module - Term - Year - Array[]
+ Update Student Tables() + Get Student Objects ()

LectGetStudent class to handle the connection between the Lecturer and the Server Gets the student details from the server

Lect Retrieve
- Client Connection - Save Dir - Std
+ Retrieve ()

LectRetrieve class to handle retrieving the project files belonging to a student project from the server to the client

My Protocol
- Start - Pass - Date - Send Project - Request Project - Analyze - Quit - State - Security Clear
+ Response () + Set Security Clear ()

MyProtocol class to handle the protocol states between the Client and Server

Read Config
- Host - Port
+ Read Config () + Read File () + Parse Key () + Get Host ()

ReadConfig class to read the configuration files for server and client

Lect Set Grade
- Client Connection - Student Project
+ Set Grade

LectSetGrade class to set the student grade

Password
- Username - Password - Digest - Random
+ Password () + Encrypt () + Merge Array () + Finalize () + Trace ()

Our top level password class , password and username will be protected through the use of message digest 5 . It will be provided by the java.security package

Server
- Port - Server Socket - Server Config File - Read Config - Path
+ Server Init() + Listen () + Finalize ()

Main server class used for listening for incoming connection

Server Get Projects
- Year - Term - Module - Path - Input - Output - My Array - Compare

+ Unit Request () +Set Grade () + Send Proj File () + Construct Rel Path () + Send Student Objs () + Find Project () + Construct Stud Objs () + Read Student File ()

**ServerGetProjects class to handle request for incoming student projects.
This single server class will handle all request for student projects.
Its client counterparts are LectRetrieve class , client class which handles the client retrievingof files from server , LectSetGrade class ,client class which handles the client setting of grade, LectGetStudent class, client class which handles the getting of student details to be display on client JTable from server.**

StudentProject
- StudentId - StudentName - Lecturer - ProjectTitle - Term - Module - Year - Grade - Comments - submittedDate

+ setStudentid()
+ setStudentName()
+ toString()

class to hold information for each student project

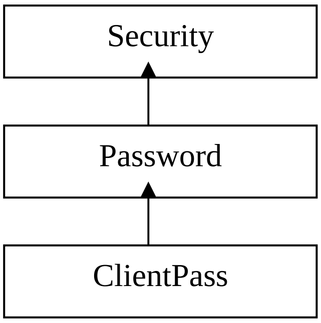
SubmitServer
- StudentName - StudentId - Lecturer - ProjectTitle - ProjectSummary - Term - Module - CurDate - ProjectFilePath

- SourceDirectory
- Connection
- PassHandler

+ getSourceBaseDirectory()
+ getSourceDirectory()
+ resetcon()
+ submitProjFile()
+senBinFile()

class that handles the submitting of project from studentscreen to the server

Password Relationship

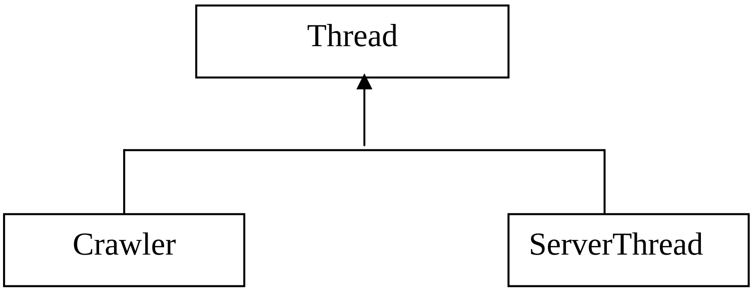


ClientPass

- byte[] result
- byte[] buser
- byte[] bpass
- byte[] temp
- Random ranobj

+ Setcon()
+ Scramble()
+ Cleanup()

**ClientPass class to handle password authentication with the server
it extends our base Password class**


Thread
Crawler
ServerThread

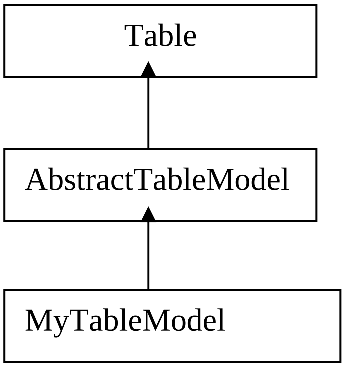
Crawler
- String PATH - String classpat - Vector myvect - Pattern mthp - Pattern classp - crawlFile = new Vector() - private int crawlcnt

+ run()
+ buildCrawl()
+ getCrawlResults()
+ compareCrawl()
+ crawlWriteResults()

This is our ai class , called crawler to actually search through our server data directory. It will find all student folders , and go into each modules folder in each student folder analyse the source files found in the source folder in each module folder and generate a unique signature for each module. Then it will compare such signature files in an attempt to determine
whether there is any plaigarism . The result will be written to ai.dat and grade.dat

Server Thread File
- My Plan - Check - Mod - Path - Src
+ Get Project Details () + write Main Server Index () + Get source File () + Create Src Dir () + Write Project Index File () + Get Project Document () + Initial () + Write Project ()

our individual thread server classes that will be handling each incoming client connections. Each incoming client connection will be assigned a single thread that will handle it.

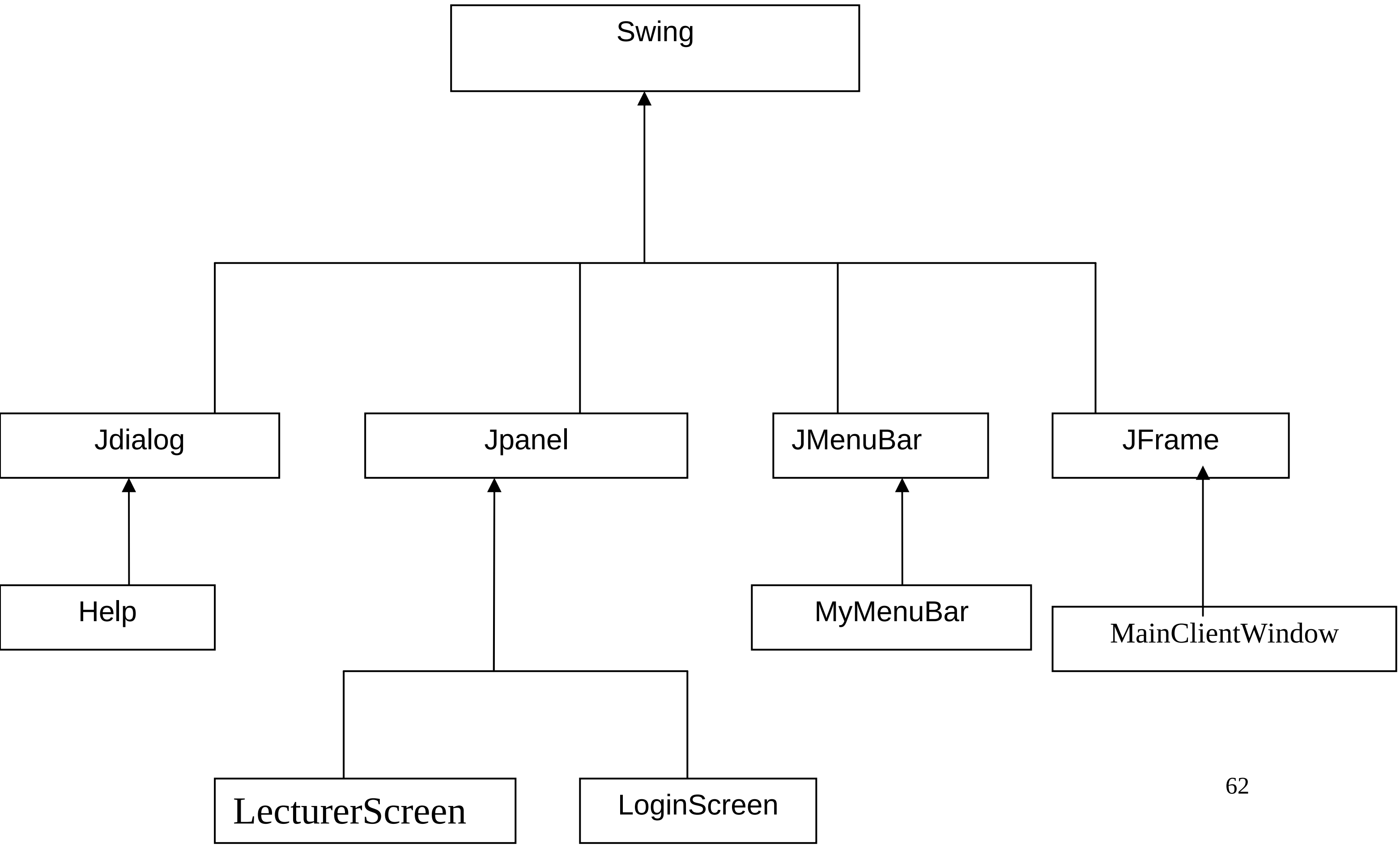


MyTableModel

- boolean DEBUG=false;
- final String[] columnNames

+ getColumnCount()
+ getColumnName()
+ isCellEditable()
+ printDebugData()

`TableModel class to format all the student details that appear in the`
JTAble. This class is based upon the sample provided by the Sun Java Tutorial. I have built upon and expanded on it so that it can handle my student objects for ProjectManager.



LectScreen
- MainClientWindow win - ClientConnection con - ClientPass passhandler - GridBagConstraints constraints - GridBagLayout gb - JTable mytable - JTextArea mytextarea - JComboBox cterm , cmodule , cyear - JButton bupdate , bretrieve , banalyse , bsetgrade - LectAct myact - myTableListener tableact - StudentProject[] mystd - File savedir - int mySelectrow = -1 - String year - String term - String module

+ setStudentGrade(0
+ browseSave(0
+ valueChanged()
+ buildHeading()
+ getDate()
+ buildTop()
+ buildMiddle()
+ buildBottom()

This class creates the Graphic User Interface for the user.

LoginScreen
- MainClientWindow win - ClientConnection con - ClientPass passhandler - JPasswordField passfield - JTextField userfield - JButton blogin , bexit - byte[] password - String username - Box ubox, pbox , bbox

+ getPassword()
+ Scramble()

LoginScreen for the user to enter password

MainClientWindow
- MyMenuBar mymbar - ClientConnection con - LoginScreen mylogin

+ WindowClosing()
+ dispose()
+ cleanup()

MainClient Screen to launch the client GUI

MyMenuBar
- JMenu fmenu ; - JMenu hmenu ; - ClientConnection con; - MainClientWindow win;

+ buildMenu()
+ showAbout()
+ showHelp()

MyMenuBar Class to build the GUI menubar

Appendix 6

Sample code

```
/** clientConnection class to enable the client to get a socket to link to the server

   ProjectManager
   copyright Raji nov 2003
   */

package projectmanager;

import java.net.*;
import java.io.*;

public class ClientConnection {

         private Socket clientsock ;
         private String hostname ="127.0.0.1";  //default localhost
         private int port = 5001;               //default portnumber
         private DataInputStream in;
         private DataOutputStream out;

         /** Default constructor, will read from configuration file and set the host and port */
         public  ClientConnection()
         {

     ReadConfig rcfg = new ReadConfig("client.cfg");
     rcfg.readCFile();      //read the port and host from the client configuration file
     hostname = rcfg.getHost();   // get the host
     port = rcfg.getPort();       //get the port

     try{
           clientsock = new Socket(hostname, port);  //create a new socket with host and port
           out = new DataOutputStream(clientsock.getOutputStream()) ;     // get an output
stream from the socket
           in = new DataInputStream(clientsock.getInputStream());        //get an input stream
from the socket
                  }
           catch(IOException e){
                    System.err.println("Client connection initialization error " + e);
           }


     }

/** Second Constructor that takes a setting for hostname and port number */
public ClientConnection(String host , int port)
```

```
{
                hostname = host;
                this.port = port ;

                try{
                          clientsock = new Socket(hostname, port);
                          out = new DataOutputStream(clientsock.getOutputStream()) ;
                          in = new DataInputStream(clientsock.getInputStream());
                                }
             catch(IOException e){
                                  System.err.println("Client connection initialization error " +
e);
                        }

}



/** method to send a message to server */
public boolean send(String message) {

                try{
                        out.writeUTF(message);


                }
                catch(IOException e){

                        System.err.println("Client Send message IOException " + e);
                        return false;

                }

                return true;
}


/** method to receive a message from the server */
public String receive(){

                String msg=null;

                try{
                  msg=in.readUTF();
                }
                catch(IOException e){
                        System.err.println("Client receive message error " + e);
```

```
                    }

                    return msg ;
    }



/** method to send an array of binary data */

public boolean send(byte[] dat) {


        try{

                              out.write(dat, 0, dat.length) ;
                              out.flush();


                }
                catch(IOException e){

                              System.err.println("Client Send binary dat IOException " + e);
                              return false;

                    }

        return true;


        }

/** method to close the input and output socket streams*/

/* public void reset(){

        try {
           out.close();
           in.close();

        }
        catch(IOException e)
        {
                    System.err.println("Client connection closing error " + e);
        }
} */
```

```
/** method to receive binary array */
public int receive(byte[] buf) {

        int stat = 0;

        try{

         stat = in.read(buf);

        }
        catch(IOException e) {
               System.err.println("Error receiving binary file " + e
               return 0;
             }

             return stat;
}



/** method to close and to cleanup the connection */
public void cleanup() {

             try{
             out.close();
             in.close();

             }
             catch(IOException e){
                    System.err.println("Client Socket cleanup error" + e);
             }
}



/** A finalize method for Clientconnection */

protected void finalize() throws Throwable {

               cleanup();

  }




}
```

Code for Server connection

```
/* our main server class used for listening for incoming connection

  ProjectManager
  Copyright Raji 2003

 */


package projectmanager;

import java.io.*;
import java.net.*;
import java.util.Date;


public class Server {

   private int port=5001;         /* Default port will be set at 5001 */
   private ServerSocket serversock;
   private String serverconfigfile = "server.cfg" ;
   private ReadConfig  readconfig  ;   // class to read the server configuration
   private String PATH="C:\\PMServer" ;  //default data directory for server




   /** Default constructor , will use the default port number */
   public Server() {


                //read the server config file and get our port and data path settings

                readconfig = new ReadConfig(serverconfigfile) ;

                try{
                port =  Integer.parseInt(readconfig.parseKey("PORT"));
                }
                catch(NumberFormatException e){
                        System.err.println("Wrong server config format at port, server.cfg ");
                        System.err.println("Unable to get port number");
                        System.exit(1);
                }


                PATH = readconfig.parseKey("DATPATH");
                if(PATH == null) {
                   System.err.println("Wrong server config format at DATPATH, server.cfg
");
                         System.err.println("Unable to get DATA PATH");
                         System.exit(1);
                }

                //start the server initialization process

                serverInit();


                listen(port); //start listening for incoming connections

   }





   public void serverInit() {

            File myfile = new File(PATH);

            //check if PATH exists
            if(! myfile.exists() ) {

                        // if directory doesn't exists, create it

                        if( !myfile.mkdirs() ){
                          //if creation failed
                          System.err.println("Unable to create data directory " + PATH  + "\n"
+
                                                                   "Terminating ....... ");
                          System.exit(1);

                        }


                 }


                 //now PATH exists check if PATH is a directory
                 if( !myfile.isDirectory() ) {
                          System.err.println("Error DAT PATH is a file !" + PATH + "\n" +
                                                        "Terminating ........");
                    System.exit(1);
              }


              //checks complete successfully





       }




private void listen(int port) {

       //Create the ServerSocket

       try {


       serversock = new ServerSocket(port);

       //print out the success status and time the server is started
       System.out.println("ServerSocket created " + serversock + "\n" +
                                                   "Copyright Raji 2002 " );
       System.out.println("Server started at " + new Date());


       //loop continously waiting for client connections
       while(true) {

              Socket incoming = serversock.accept();

              System.out.println("Connection from " + incoming );

   //spawn a new thread to handle the client connection
              new ServerThread(incoming, PATH);

              }


       }
       catch(IOException e){
              System.err.println("Server IOException : " + e);
```

```
                System.exit(1);
        }

        }



  // A finalize method for the class
  protected void finalize() throws Throwable {

          serversock.close();

  }


  /* Main Method  To launch our Server daemon */
  public static void main(String[] args) {


          Server myserver = new Server();


  }

}
```

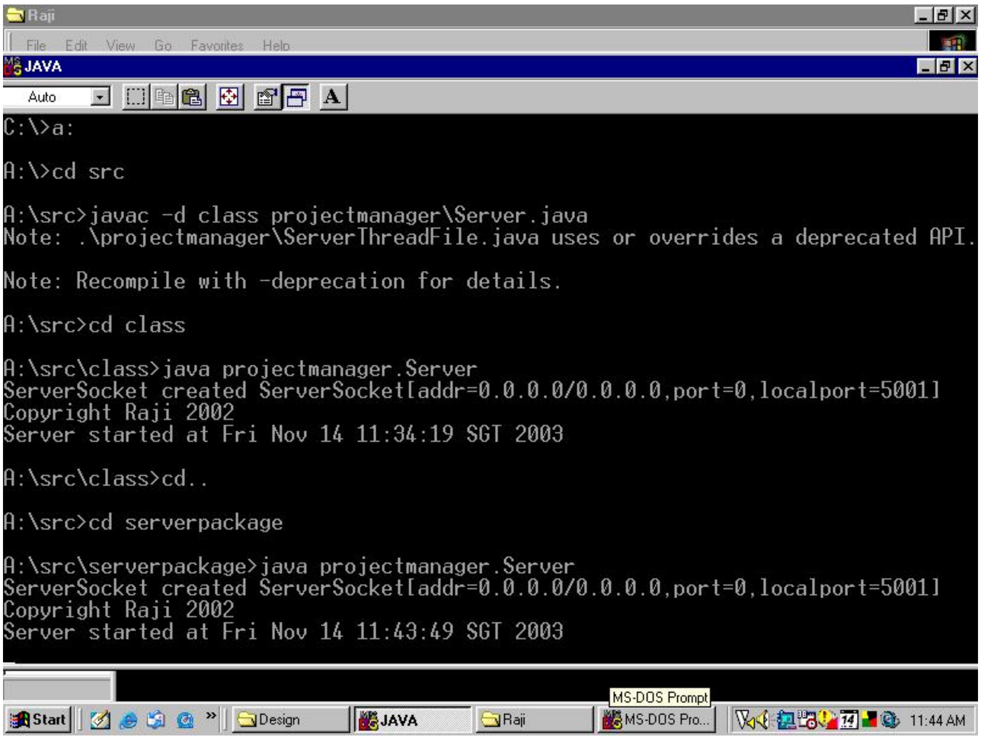
To create Table Menu

```
/* our main server class used for listening for incoming connection

  ProjectManager
  Copyright Raji 2003

 */


package projectmanager;

import java.io.*;
import java.net.*;
import java.util.Date;


public class Server {

   private int port=5001;        /* Default port will be set at 5001 */
   private ServerSocket serversock;
```

```
    private String serverconfigfile = "server.cfg" ;
    private ReadConfig  readconfig  ;   // class to read the server configuration
    private String PATH="C:\\PMServer" ;  //default data directory for server




    /** Default constructor , will use the default port number */
    public Server() {


                //read the server config file and get our port and data path settings

                readconfig = new ReadConfig(serverconfigfile) ;

                try{
                port =  Integer.parseInt(readconfig.parseKey("PORT"));
                }
                catch(NumberFormatException e){
                        System.err.println("Wrong server config format at port, server.cfg ");
                        System.err.println("Unable to get port number");
                        System.exit(1);
                }


                PATH = readconfig.parseKey("DATPATH");

                if(PATH == null) {
                   System.err.println("Wrong server config format at DATPATH, server.cfg
  ");
                        System.err.println("Unable to get DATA PATH");
                        System.exit(1);
                }

                //start the server initialization process

                serverInit();


                listen(port); //start listening for incoming connections

    }
    public void serverInit() {

            File myfile = new File(PATH);

            //check if PATH exists
            if(! myfile.exists() ) {

                    // if directory doesn't exists, create it

                    if( !myfile.mkdirs() ){
                      //if creation failed
                      System.err.println("Unable to create data directory " + PATH  + "\n"
+
                                                        "Terminating ....... ");
                      System.exit(1);

                    }


                }


                //now PATH exists check if PATH is a directory
                if( !myfile.isDirectory() ) {
                        System.err.println("Error DAT PATH is a file !" + PATH + "\n" +
                                                        "Terminating ........");
                        System.exit(1);
                }


                //checks complete successfully




        }




    private void listen(int port) {

        //Create the ServerSocket

        try {
          serversock = new ServerSocket(port);

          //print out the success status and time the server is started
          System.out.println("ServerSocket created " + serversock + "\n" +
                                               "Copyright Raji 2002 " );
          System.out.println("Server started at " + new Date());


          //loop continously waiting for client connections
          while(true) {

                    Socket incoming = serversock.accept();

                    System.out.println("Connection from " + incoming );

       //spawn a new thread to handle the client connection
                    new ServerThread(incoming, PATH);

                    }


          }
          catch(IOException e){
                    System.err.println("Server IOException : " + e);
                    System.exit(1);
          }

          }

  // A finalize method for the class
  protected void finalize() throws Throwable {

            serversock.close();
  }


  /* Main Method  To launch our Server daemon */
  public static void main(String[] args) {

            Server myserver = new Server();


  }

}
```

Appendix 7
Test Cases

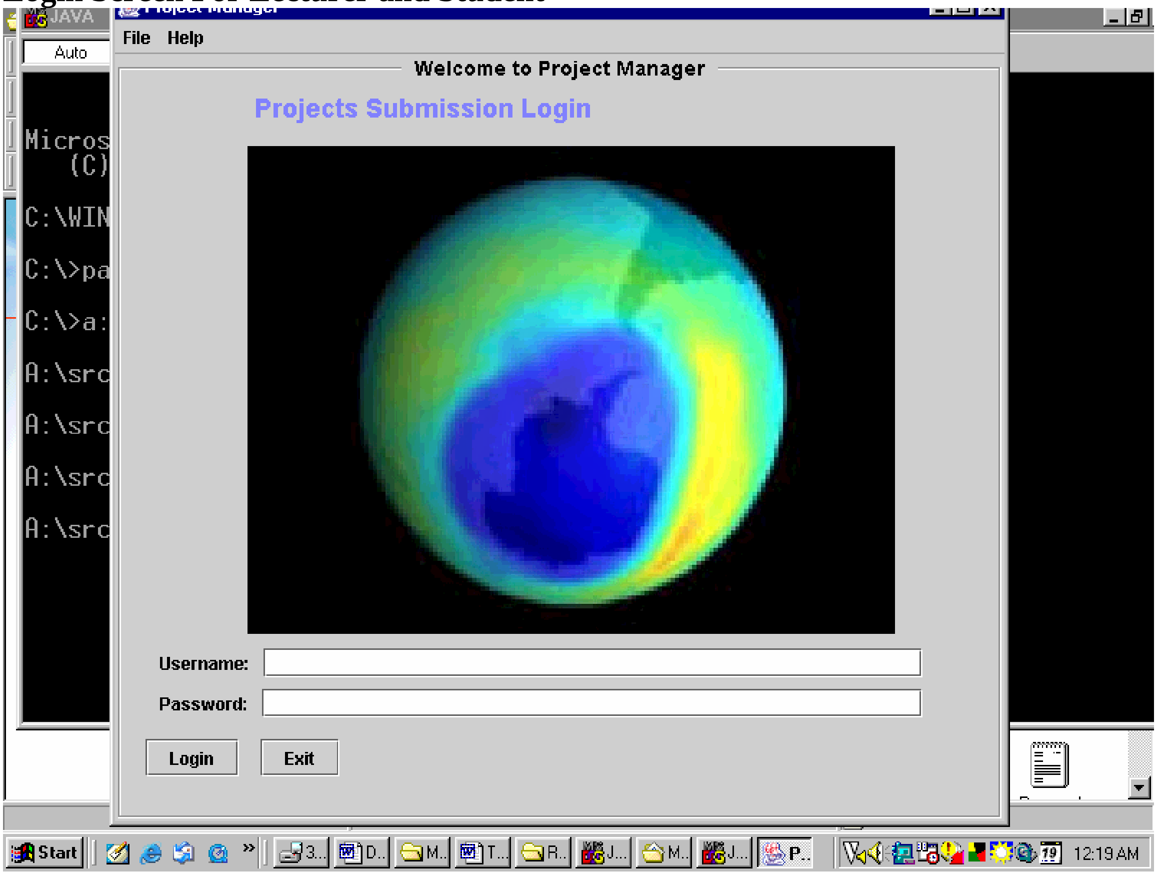
Server connection



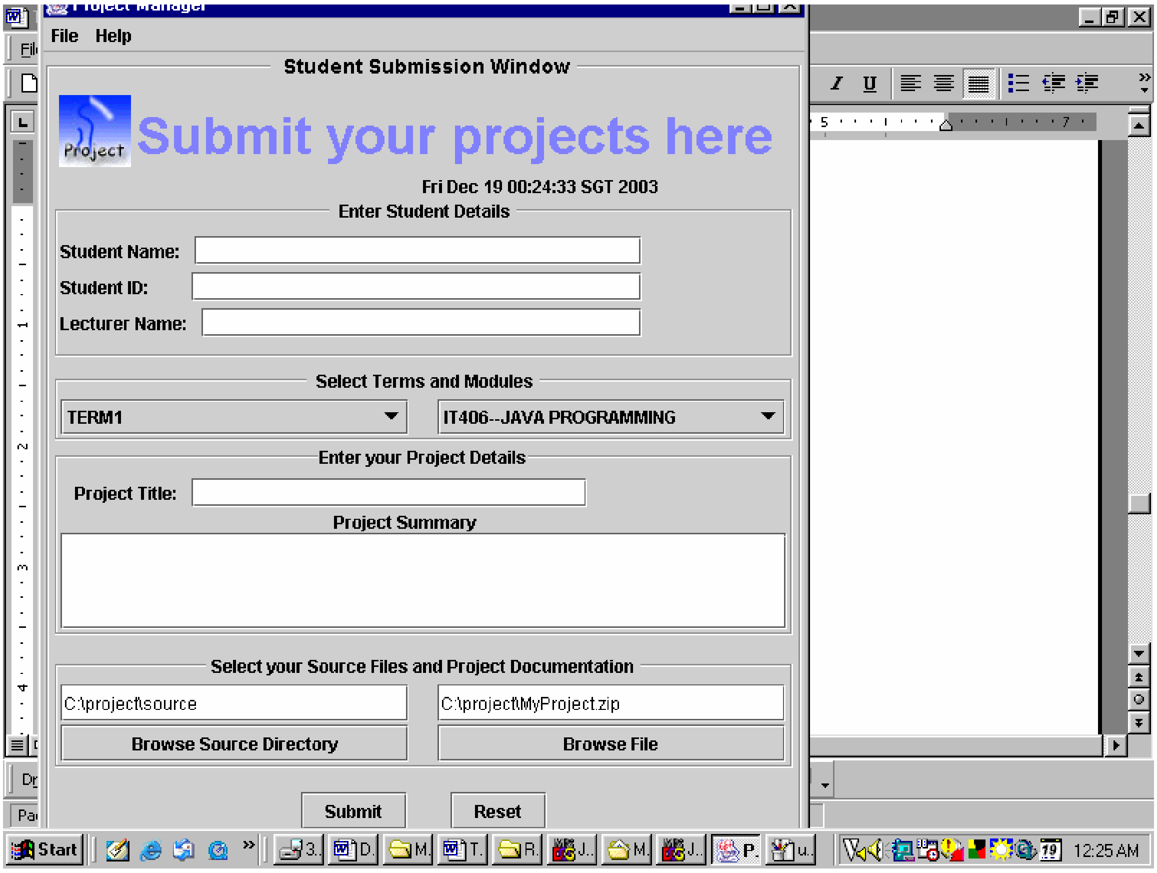
```
C:\>a:

A:\>cd src

A:\src>javac -d class projectmanager\Server.java
Note: .\projectmanager\ServerThreadFile.java uses or overrides a deprecated API.

Note: Recompile with -deprecation for details.

A:\src>cd class

A:\src\class>java projectmanager.Server
ServerSocket created ServerSocket[addr=0.0.0.0/0.0.0.0,port=0,localport=5001]
Copyright Raji 2002
Server started at Fri Nov 14 11:34:19 SGT 2003

A:\src\class>cd..

A:\src>cd serverpackage

A:\src\serverpackage>java projectmanager.Server
ServerSocket created ServerSocket[addr=0.0.0.0/0.0.0.0,port=0,localport=5001]
Copyright Raji 2002
Server started at Fri Nov 14 11:43:49 SGT 2003
```

Login Screen

Login Screen For Lecturer and Student



Student Submission Screen on successful entry of student and password



Project Manager

Student Submission Window

Submit your projects here

Fri Dec 19 00:24:33 SGT 2003

Enter Student Details

Student Name:

Student ID:

Lecturer Name:

Select Terms and Modules

TERM1

IT406--JAVA PROGRAMMING

Enter your Project Details

Project Title:

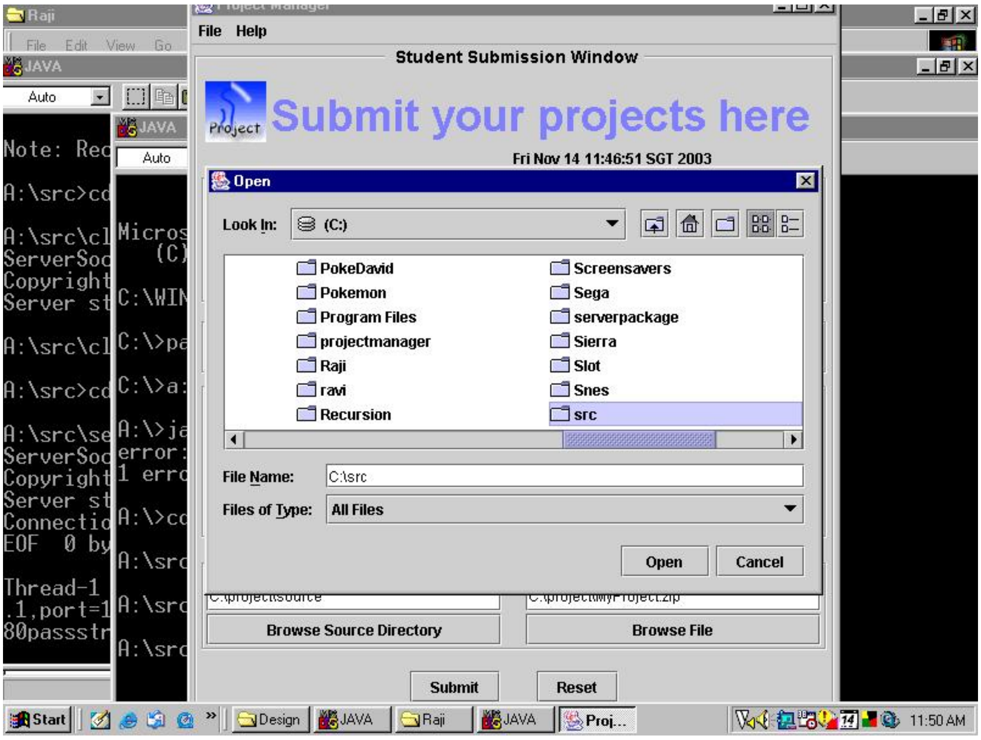
Project Summary

Select your Source Files and Project Documentation

C:\project\source

C:\project\MyProject.zip

File selection Screen



Fri Nov 14 11:46:51 SGT 2003

Look In: (C:)

PokeDavid	Screensavers
Pokemon	Sega
Program Files	serverpackage
projectmanager	Sierra
Raji	Slot
ravi	Snes
Recursion	src

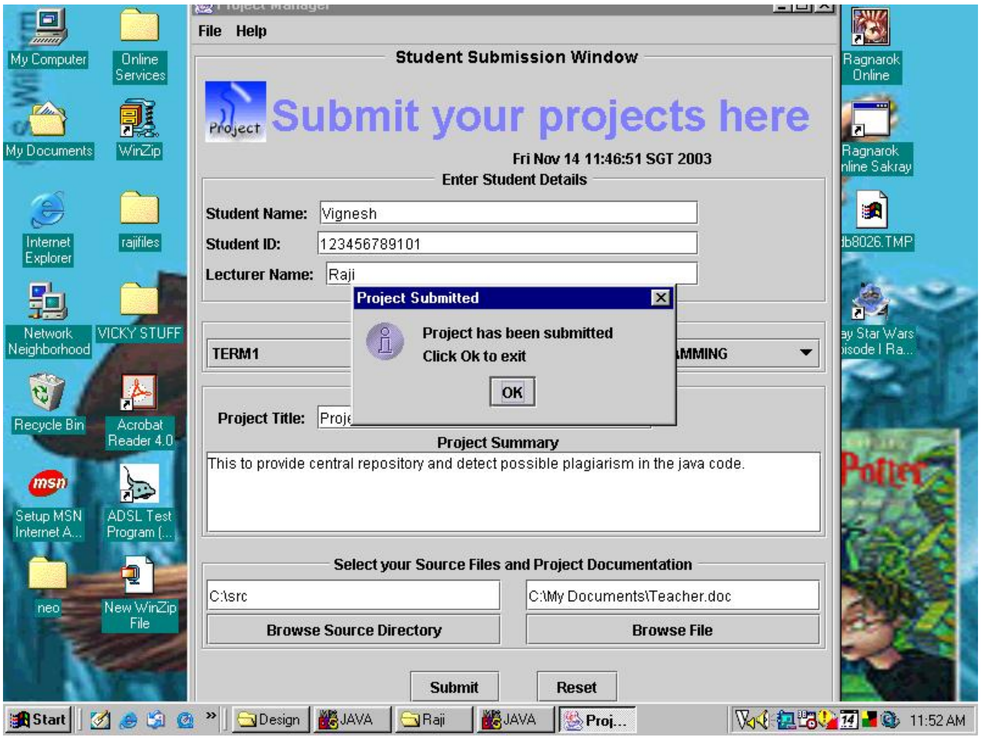
File Name: C:\src

Files of Type: All Files

```
Note: Rec
A:\src>cd
A:\src\cl
ServerSoc
Copyright
Server st
A:\src\cl
A:\src>cd
A:\src\se
ServerSoc
Copyright
Server st
Connectio
EOF  0 by
Thread-1
.1,port=1
80passstr
```

```
Micros
   (C)
C:\WIN
C:\>pa
C:\>a:
A:\>ja
error:
1 erro
A:\>cd
A:\src
A:\src
A:\src
```

Project Acknowledgement Screen



Fri Nov 14 11:46:51 SGT 2003

Enter Student Details

Student Name: Vignesh

Student ID: 123456789101

Lecturer Name: Raji

TERM1 | MMING

Project Title: Proje

Project Submitted

Project has been submitted
Click Ok to exit

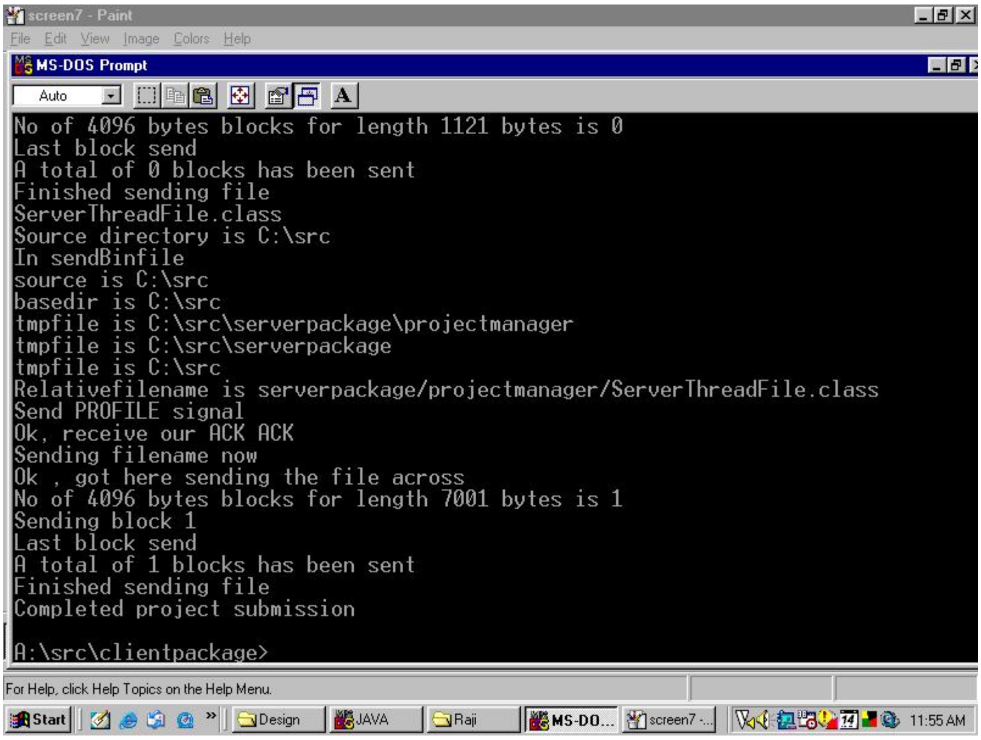
Project Summary

This to provide central repository and detect possible plagiarism in the java code.

Select your Source Files and Project Documentation

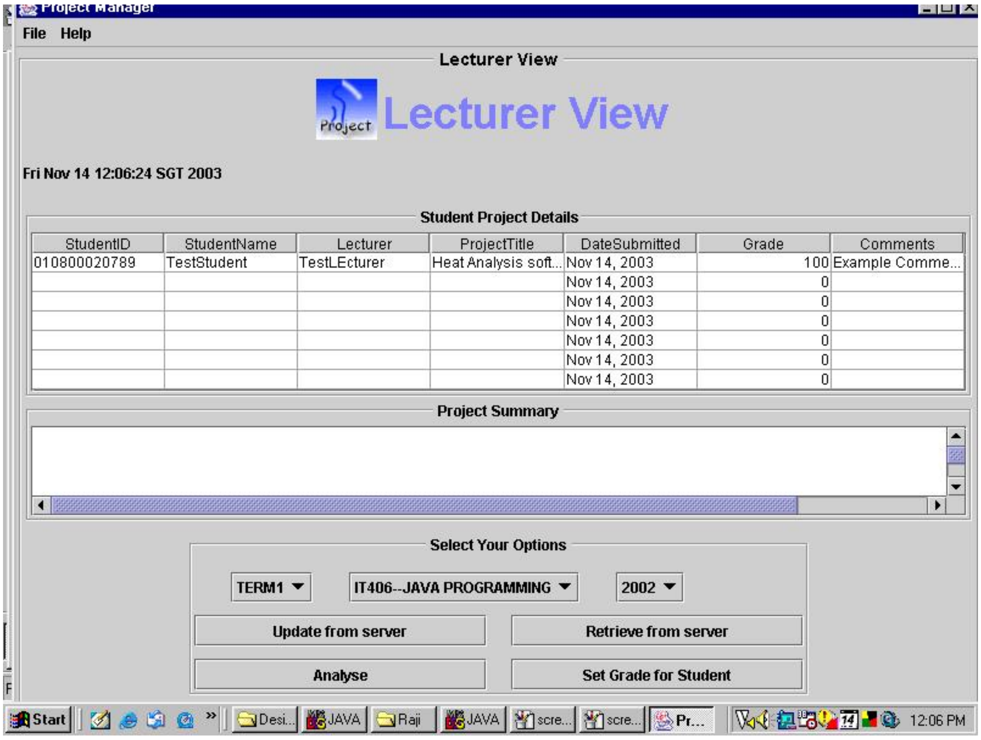
C:\src | C:\My Documents\Teacher.doc

Acknowledgement from Server



```
No of 4096 bytes blocks for length 1121 bytes is 0
Last block send
A total of 0 blocks has been sent
Finished sending file
ServerThreadFile.class
Source directory is C:\src
In sendBinfile
source is C:\src
basedir is C:\src
tmpfile is C:\src\serverpackage\projectmanager
tmpfile is C:\src\serverpackage
tmpfile is C:\src
Relativefilename is serverpackage/projectmanager/ServerThreadFile.class
Send PROFILE signal
Ok, receive our ACK ACK
Sending filename now
Ok , got here sending the file across
No of 4096 bytes blocks for length 7001 bytes is 1
Sending block 1
Last block send
A total of 1 blocks has been sent
Finished sending file
Completed project submission

A:\src\clientpackage>
```

Lecturer Screen



Fri Nov 14 12:06:24 SGT 2003

Student Project Details

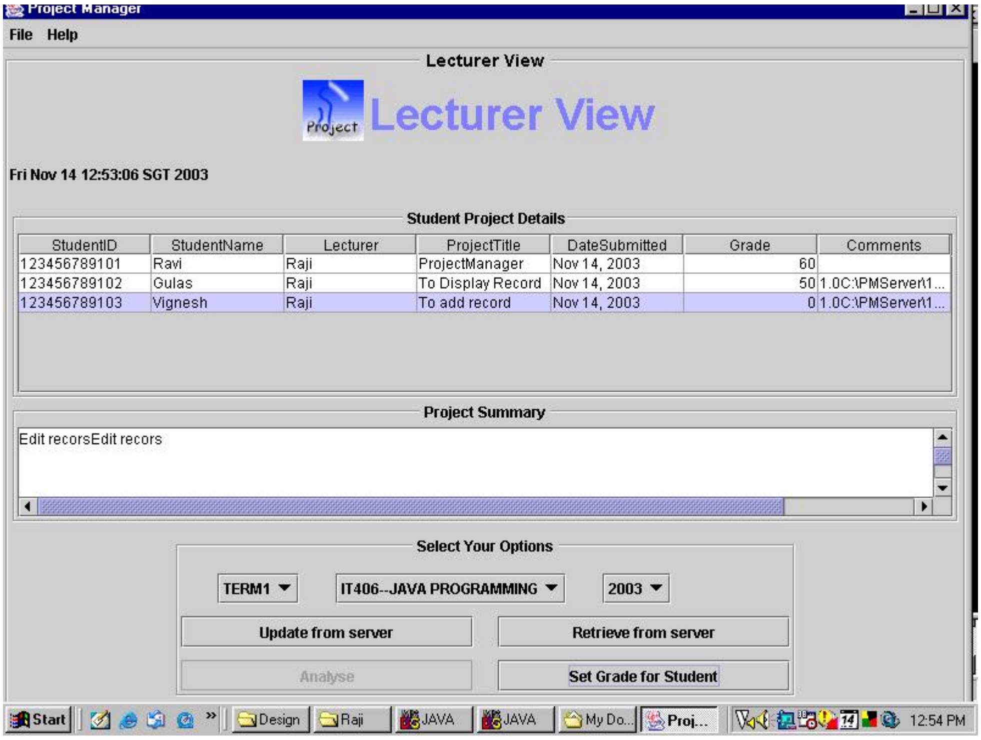
StudentID	StudentName	Lecturer	ProjectTitle	DateSubmitted	Grade	Comments
010800020789	TestStudent	TestLEcturer	Heat Analysis soft...	Nov 14, 2003	100	Example Comme...
				Nov 14, 2003	0	
				Nov 14, 2003	0	
				Nov 14, 2003	0	
				Nov 14, 2003	0	
				Nov 14, 2003	0	
				Nov 14, 2003	0	

Project Summary

Select Your Options

TERM1 ▾ IT406--JAVA PROGRAMMING ▾ 2002 ▾

View Projects from Server



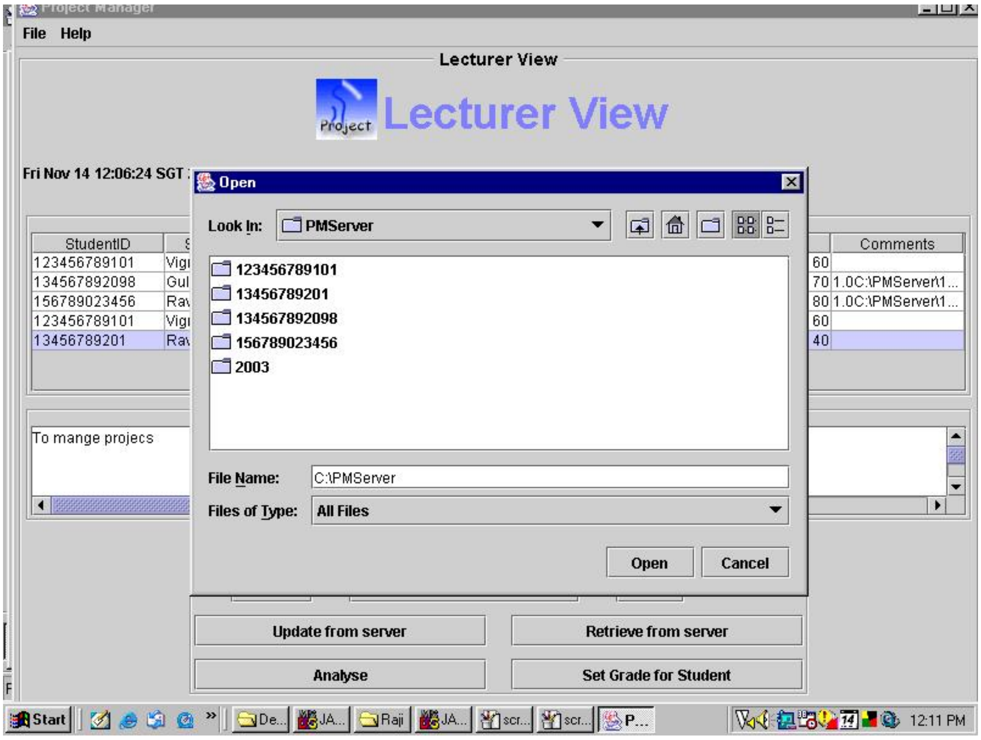
Fri Nov 14 12:53:06 SGT 2003

StudentID	StudentName	Lecturer	ProjectTitle	DateSubmitted	Grade	Comments
123456789101	Ravi	Raji	ProjectManager	Nov 14, 2003	60	
123456789102	Gulas	Raji	To Display Record	Nov 14, 2003	50	1.0C:\PMServer\1...
123456789103	Vignesh	Raji	To add record	Nov 14, 2003	0	1.0C:\PMServer\1...

Edit recorsEdit recors

TERM1 | IT406--JAVA PROGRAMMING | 2003

Retrieve Projects from Server



Fri Nov 14 12:06:24 SGT

StudentID	S		Comments
123456789101	Vigi	60	
134567892098	Gul	70	1.0C:\PMServer\1...
156789023456	Rav	80	1.0C:\PMServer\1...
123456789101	Vigi	60	
13456789201	Rav	40	

To mange projecs

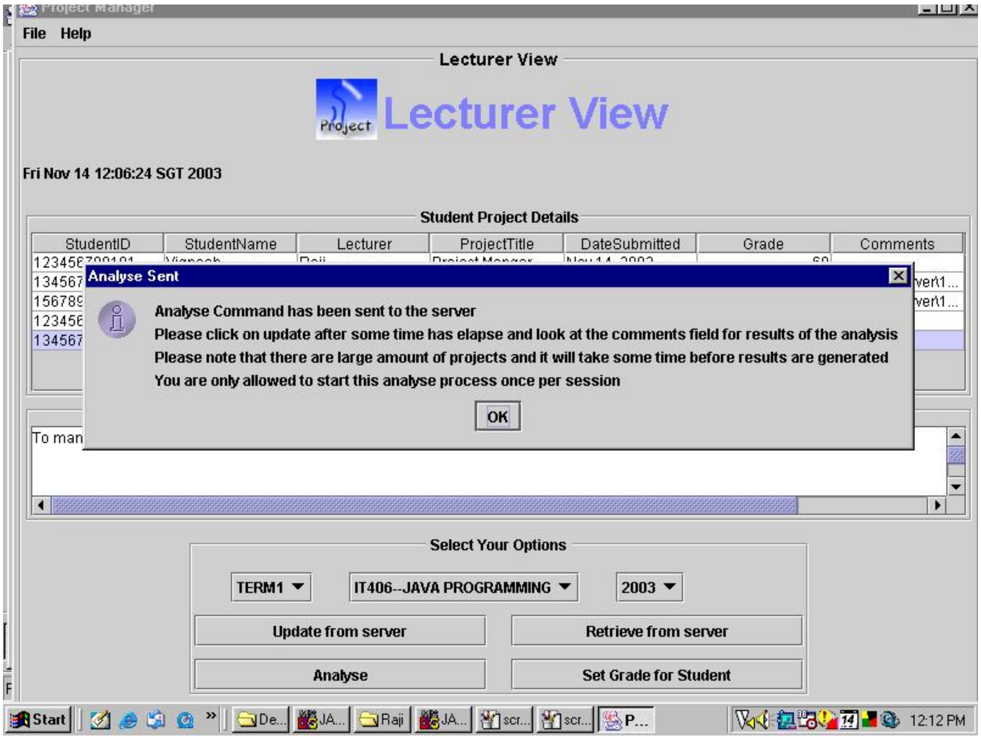
Look In: PMServer

- 123456789101
- 13456789201
- 134567892098
- 156789023456
- 2003

File Name: C:\PMServer

Files of Type: All Files

Analyse Projects



Fri Nov 14 12:06:24 SGT 2003

Student Project Details

StudentID	StudentName	Lecturer	ProjectTitle	DateSubmitted	Grade	Comments
123456789101	Vignesh	Raji	Project Manager	Nov 14, 2003	60	
134567						ver\1...
15678						ver\1...
123456						
134567						

Analyse Sent

Analyse Command has been sent to the server
Please click on update after some time has elapse and look at the comments field for results of the analysis
Please note that there are large amount of projects and it will take some time before results are generated
You are only allowed to start this analyse process once per session

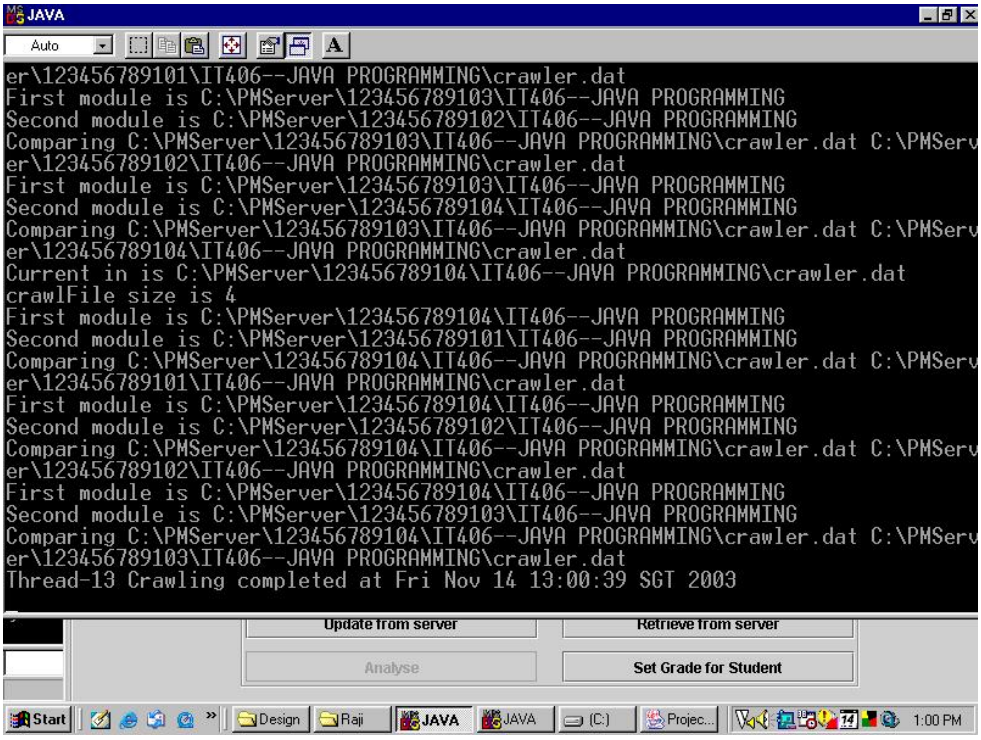
OK

To man

Select Your Options

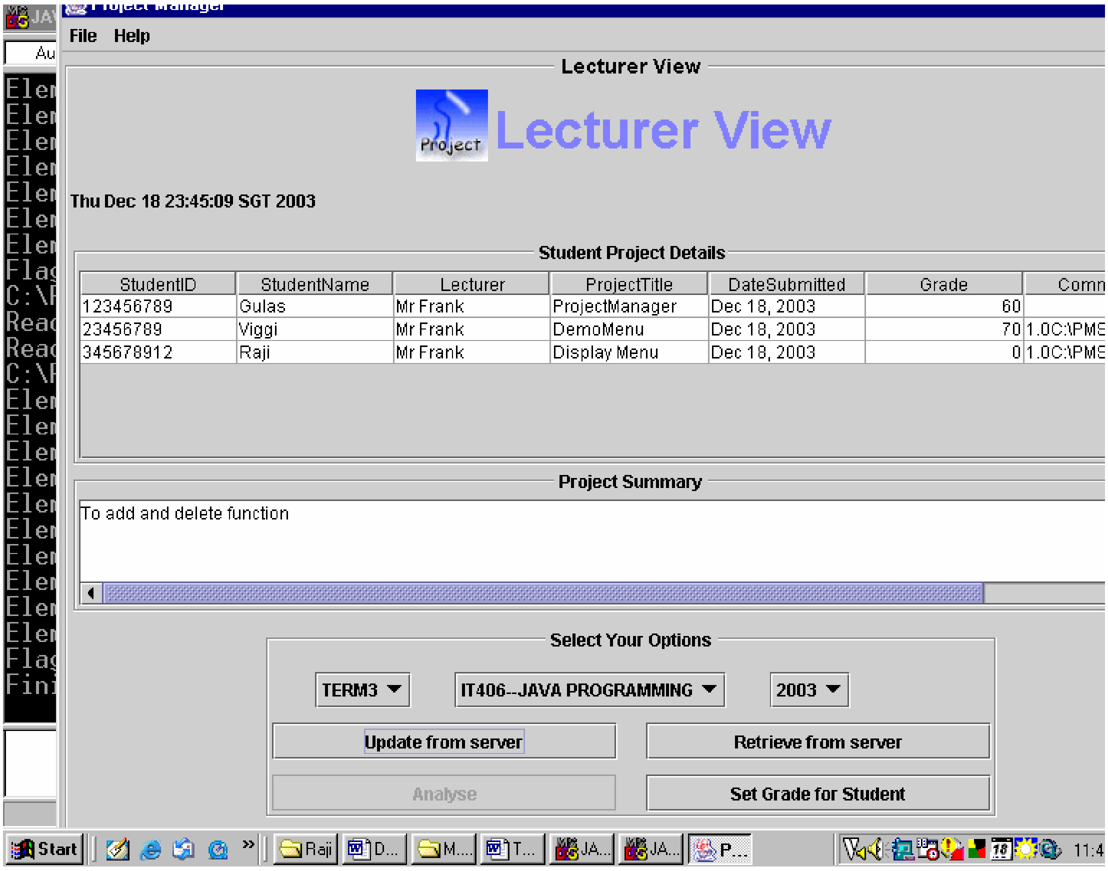
TERM1 ▼ IT406--JAVA PROGRAMMING ▼ 2003 ▼

Acknowledgement for analyzing projects



```
er\123456789101\IT406--JAVA PROGRAMMING\crawler.dat
First module is C:\PMServer\123456789103\IT406--JAVA PROGRAMMING
Second module is C:\PMServer\123456789102\IT406--JAVA PROGRAMMING
Comparing C:\PMServer\123456789103\IT406--JAVA PROGRAMMING\crawler.dat C:\PMServ
er\123456789102\IT406--JAVA PROGRAMMING\crawler.dat
First module is C:\PMServer\123456789103\IT406--JAVA PROGRAMMING
Second module is C:\PMServer\123456789104\IT406--JAVA PROGRAMMING
Comparing C:\PMServer\123456789103\IT406--JAVA PROGRAMMING\crawler.dat C:\PMServ
er\123456789104\IT406--JAVA PROGRAMMING\crawler.dat
Current in is C:\PMServer\123456789104\IT406--JAVA PROGRAMMING\crawler.dat
crawlFile size is 4
First module is C:\PMServer\123456789104\IT406--JAVA PROGRAMMING
Second module is C:\PMServer\123456789101\IT406--JAVA PROGRAMMING
Comparing C:\PMServer\123456789104\IT406--JAVA PROGRAMMING\crawler.dat C:\PMServ
er\123456789101\IT406--JAVA PROGRAMMING\crawler.dat
First module is C:\PMServer\123456789104\IT406--JAVA PROGRAMMING
Second module is C:\PMServer\123456789102\IT406--JAVA PROGRAMMING
Comparing C:\PMServer\123456789104\IT406--JAVA PROGRAMMING\crawler.dat C:\PMServ
er\123456789102\IT406--JAVA PROGRAMMING\crawler.dat
First module is C:\PMServer\123456789104\IT406--JAVA PROGRAMMING
Second module is C:\PMServer\123456789103\IT406--JAVA PROGRAMMING
Comparing C:\PMServer\123456789104\IT406--JAVA PROGRAMMING\crawler.dat C:\PMServ
er\123456789103\IT406--JAVA PROGRAMMING\crawler.dat
Thread-13 Crawling completed at Fri Nov 14 13:00:39 SGT 2003
```

View Comments



Thu Dec 18 23:45:09 SGT 2003

StudentID	StudentName	Lecturer	ProjectTitle	DateSubmitted	Grade	Comn
123456789	Gulas	Mr Frank	ProjectManager	Dec 18, 2003	60	
23456789	Viggi	Mr Frank	DemoMenu	Dec 18, 2003	70	1.0C:\PMS
345678912	Raji	Mr Frank	Display Menu	Dec 18, 2003	0	1.0C:\PMS

To add and delete function

TERM3 ▼ IT406--JAVA PROGRAMMING ▼ 2003 ▼