UNIVERSITY OF MAURITIUS

FACULTY OF ENGINEERING

COMPUTER SCIENCE AND ENGINEERING DEPARTMENT

A WEB-BASED FINAL YEAR PROJECT SUPERVISION SYSTEM

In Partial Fulfilment for BSc (Hons) Computer Applications

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For the grateful person knows that God is good, not by hearsay but by experience. And that is what makes all the difference." — Thomas Merton

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ABSTRACT

All undergraduate students at the Computer Science and Engineering (CSE) Department, University of Mauritius are expected to undertake a project in their final year, supervised by full time academics. Currently, project supervision is performed on an ad-hoc basis and varies widely in style depending on the supervisor. Another issue that has emerged recently is the rise in the number of student intakes for the CSE Department. As a result, academics have a higher workload and an increasing number of final year projects to supervise. Therefore, they tend to have less time for supervision due to more hours spent in delivering lectures and attending lab sessions. As such, the quality of supervision tends to suffer and may eventually impact students' performance due to lack of proper guidance and reduced motivation. This project proposes a web-based multi-user system, referred to as the Project Supervision System (PSS), to facilitate interaction between students and supervisors through functionalities such as messaging, progress report submissions and feedback from supervisors, progress monitoring through dynamic Gantt charts and appointment requests management, among others. PSS has been evaluated using project proposals for the year 2012/2013 and a number of final year students undertaking projects at the CSE Department along with a few academics have been requested to use and provide feedback on the system. PSS has been welcomed by most of them as a system which considerably enhances the quality and timeliness of guidance received by students from their supervisors and alleviates some of the difficulties faced by academics in their supervision duties. PSS can be considered as a major step towards improving project supervision, although additional features and functionalities can be added in the future.

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CHAPTER 1 – INTRODUCTION

The final year project undertaken at the tertiary level is considered of utmost importance as it usually marks the end of several years of study and is indispensable in the process of acquiring the long-awaited degree. The University of Mauritius is no exception and final year students are allocated a project which has been proposed by a full-time academic staff or by the students themselves.

The undertaking of final year projects aims at eventually imparting the students with skills such as enhanced problem-solving abilities, independent, creative and lifelong learning, built-up confidence level and better readiness to join the industry. To ensure that these objectives are effectively met, proper guidance should be provided to the students by their project supervisors.

The Computer Science and Engineering (CSE) department allocates a supervisor to each team of students which usually consists of two students but can also be a single student per project. The project supervision is performed through regular meetings and email communication between the two parties to discuss the project's progress.

1.1 Problem Statement

Project supervision is presently performed on an ad-hoc basis - therefore varying widely in style depending on the supervisor. While the adaptation of the students to their supervisors' differing styles is justified by the department as 'part of their learning experience to work with different kind of people', it would have been highly desirable to adopt a methodical and uniform supervision approach for ensuring greater fairness among all students. The current practices and their inefficiencies are explored in more details in the Analysis section (see Chapter 3) of this report. A brief of the main problems that this project addresses is provided below:

1.1.1 Meeting Scheduling

One of the pillars for project supervision is regular meetings between students and their supervisors. Supervisors with their busy work schedules and students with their differing timetables face difficulties in scheduling meetings. Agreeing on a particular date and time for a meeting involves exchanges of several emails at times. Things worsen when one of the parties request for a meeting to be postponed.

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1.1.2 Conducting Meetings

Currently, the only way to keep a record of what has been discussed during a project meeting is by writing a short comment of a few words in Project Progress Logs. Very often, this is not done or is insufficient to properly describe the project's progress and provide written advice. As a result, doing follow-ups on previous advices and the extent to which they have been followed by the students becomes quite challenging.

1.1.3 Progress Tracking

The predominating process of not filling the progress log (see Appendix A) after each meeting often results in both the supervisors and students losing track of the real progress of the project and whether the different deadlines for the milestones set are being respected. Although the log is filled occasionally, the approach remains inadequate to track even the basic development of the project. This is due to the fact that the log neither reflects the work done nor shows whether deliverables are submitted on time.

1.1.4 Project Supervision

The lack of concrete feedback on the part of the supervisor in the progress log supplements the already existing difficulties faced by students and further obstructs the project's flow. While one would not go as far as questioning the project supervision abilities of lecturers, a problem still remains to be addressed at the level of the project supervision process itself where each supervisor has his own way of dealing with his project students – be it regarding project meetings or deliverable submissions, which in turn raises scepticism about the whole heterogeneous procedure.

The problems related to meeting scheduling and progress tracking, when combined, make the project supervision process a tedious task, which get worse as the number of students to supervise increases for each academic.

1.2 Proposed Solution

A dynamic web-based multi-user system for final year project supervision is being proposed as solution to address the challenges and inefficiencies posed by the current project supervision techniques. While the project does not seek an alternative to face-to-face meetings, the Project Supervision Systems (PSS) will be a complement by providing an online platform to enable a 24/7 project supervision for the benefit of both students and academics alike. PSS will enable students to send appointment requests to

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their supervisors while the latter can easily respond with additional information if needed. Viewing of a supervisor timetable will be a feature to be made accessible to students so that they can pick meeting times at which supervisors are more likely to be available. Online uploading of progress reports by students about which supervisors can post reviews is another prominent functionality to be proposed along with the instant messaging capability, dynamic Gantt Charts for viewing projects' progress and a project description search web service will also be made available on PSS.

1.3 Aims and Objectives

1.3.1 Aims

The main aim is to consolidate the project supervision process and enhance the final year project experience for stakeholders using information technology to transform basic data about project meetings and deliverable submissions into meaningful information.

The intent is:

1. To provide a project monitoring and supervision system for supervisors
2. To assist supervisors in taking appropriate decisions regarding students' progress.
3. To keep stakeholders informed and updated about final year project titles and ideas.
4. To present fairer results based on overall effort put into the project for final grading purposes.

1.3.2 Objectives

The following objectives that comply with the requirements of stakeholders need to be met to achieve the above-mentioned aims:

1. Develop a multi-user web-based platform which can be securely accessed by final year students and academics from the Computer Science and Engineering Department. The system should ensure different access roles for the users and customise the information which is displayed to them accordingly.
2. The system should enable supervisors to monitor students' progress in undertaking their final year projects which can be made possible by enabling students to easily interact with their supervisors through online messaging,

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uploading of progress reports and reception of feedback and reviews from the supervisors.

3. To enable supervisors to share their timetable with their project students through online calendars and automatically create new events on the calendars whenever supervisors accept appointment requests from students.
4. Simplify the task of sending appointment/meeting requests by students to their supervisors while at the same time making it intuitive for supervisors to respond to these requests.
5. Enable supervisors to create and manage milestones with starting and ending dates which are automatically converted into graphical Gantt charts viewable by students.
6. Provide a Web Service to be used by academics, students and researchers from both the University of Mauritius and outside to search for past projects, which can be beneficial for proposing following projects or undertaking more advanced research.

1.4 Project Scope

The project is going to focus on final year project supervision after the projects have already been allocated to students and the latter have been assigned supervisors. The system to be developed will be adapted for full-time undergraduate students from the Computer Science and Engineering (CSE) Department in the first instance but eventually may be extended to other students both from within the CSE Department and outside.

1.5 Methodology

- Existing research work undertaken in the field will be reviewed while existing similar/related systems will be critically analysed, compared and discussed.
- Information about the current context, that is, how project supervision is being actually performed at the CSE department will be gathered through different techniques, including but not limited to interviews and observation.
- Problems and inefficiencies of the current methods used at the department will be discussed and a number of possible solutions will be proposed along with the main functional and non-functional requirements of a most suitable solution.

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- The most suitable solution based on the different constraints prevailing will be described together with the different development tools and techniques will be described.
- The solution will be designed through a number of techniques, including UML diagrams, pseudo-codes to describe algorithms and also tentative interface designs will be drawn. The database architecture and schema will also be decided and explained through a data dictionary.
- The different implementation issues will be discussed along with details about the implementation of the main modules and components for the system.
- The developed PSS system will be thoroughly tested throughout its development starting from the very beginning of the project till the end. As for the software testing, different methods will be used and whenever possible, existing and proven software testing tools will be employed.
- An evaluation of PSS will be done by requesting students and supervisors to use the system and their feedback will be gathered to be analysed for use in future improvement of the system.

1.6 Project Schedule

At the beginning of the project, a tentative timeline as shown in Figure 1 with milestones has been agreed between the author and the supervisor. This was followed most of the time although minor amendments during the project's undertaking were brought forward.

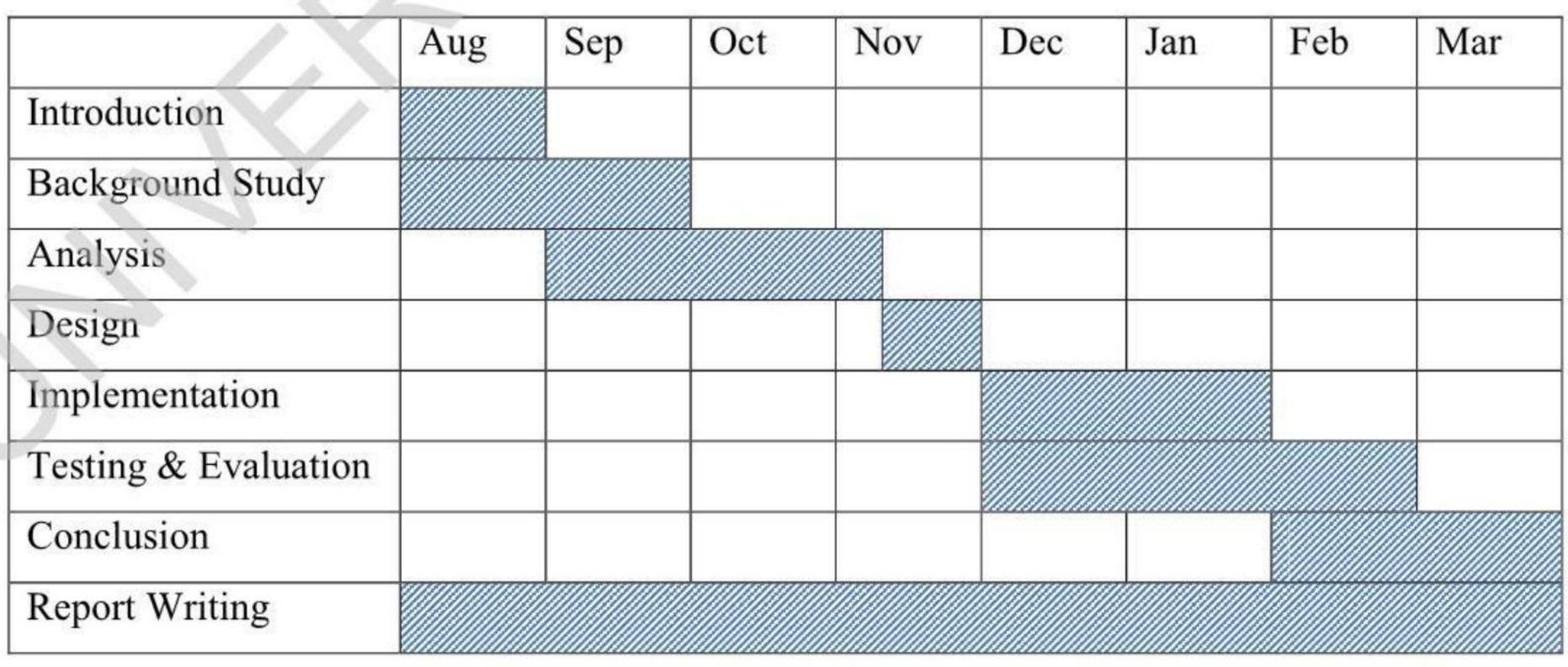

Figure 1: Project Timeline

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CHAPTER 2 – BACKGROUND STUDY

This chapter begins with a literature review and is further divided into sections describing projects and project management, and project management for educational purposes respectively. Finally, the chapter ends with a description of the potential tools and technologies that can be used to implement the project.

2.1 Literature Review

The literature review focuses on works that have been carried out in the domain of final year projects supervision by various universities.

1) Web Environment to Manage Undergraduate Projects at the City University of Hong Kong

A final year project carried out by Wing Sze [1] in 2008 involved creating a web-based tool to manage undergraduate projects. The idea had been to provide interfaces to help supervisors and students to organise their collections of learning resources in terms of research papers, findings and discussions relevant to project topics that could then be reused in other projects dealing with similar subjects.

2) Use of Social Software for Final Year Project Supervision at the University of Portsmouth

In his work entitled *Use of social software for final year project supervision at a campus based university* in the year 2008, Malik [2] from the University of Portsmouth presented a combination of social software namely Twitter, and a wiki-based approach to help supervisors identify students' needs. The research proposed the use of social software to facilitate information sharing and interactions among the supervisor and the project students while making use of social networking.

3) Web-based Project Management System at Universiti Tun Abdul Razak

A final year project undertaken by Aziz [3] in 2009 consisted of a web-based project management system to help stakeholders involved in final year projects by providing timely and relevant information to project coordinators, supervisors, moderators and students. The system termed "Damshiq" had been fundamentally a portal for the four categories of users to collaborate online and share information pertaining to final year projects.

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4) Final Year Supervision Management System at Universiti Kebangsaan Malaysia

A project by Marini Abu Bakar et al. [4] in 2010 from Universiti Kebangsaan Malaysia involved a web-based supervision management system that had been developed to improve project monitoring and supervision. The observation of a growing number of project students following Computer Science courses, failing to complete software development within the allocated time, formed the basis of the study. The project consisted of user management, project monitoring including software development and report-writing, and appointment setting.

Figure 2: Project Developed at Universiti Kebangsaan Malaysia – Supervisor Menu

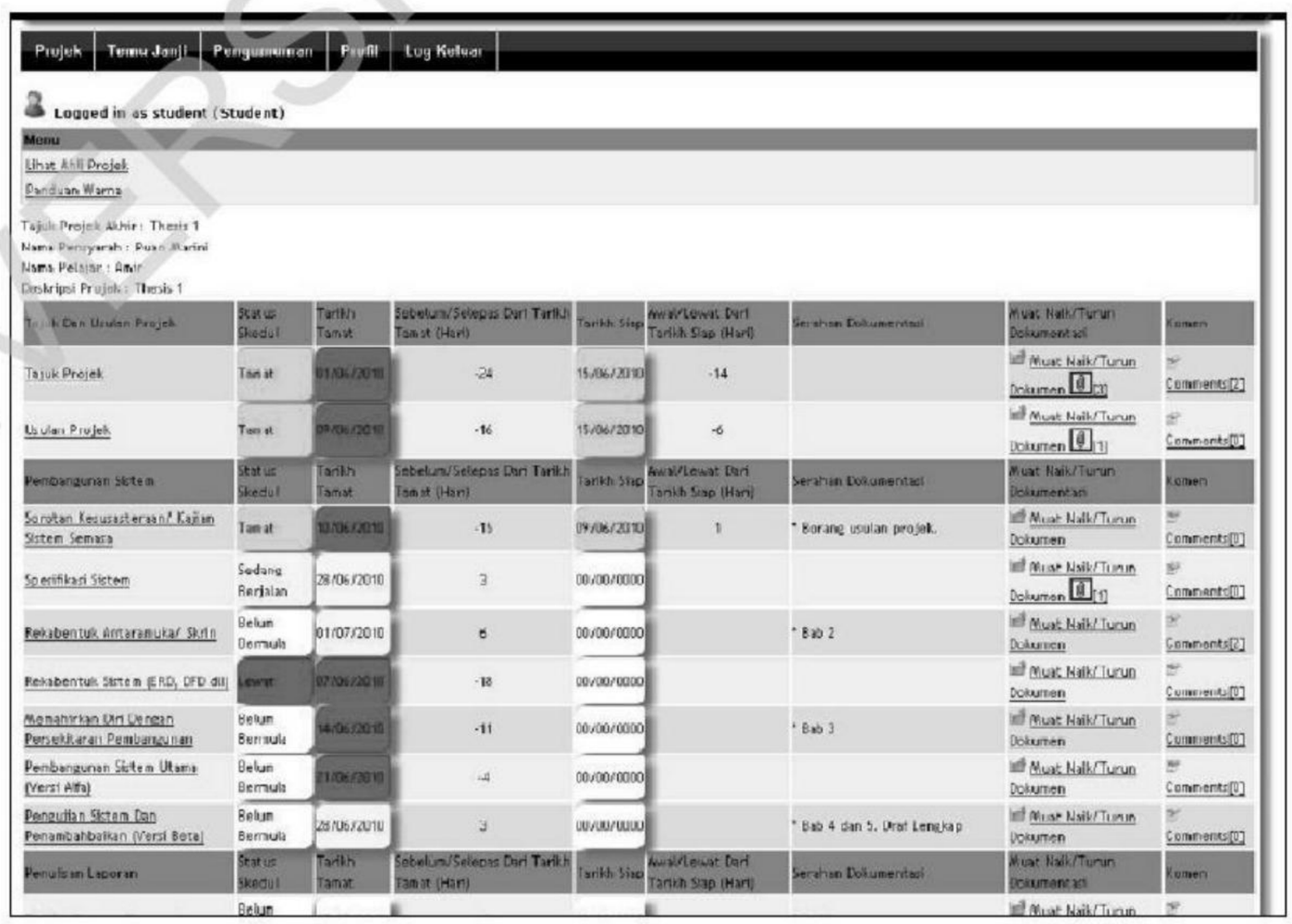

Figure 3: Project Developed at Universiti Kebangsaan Malaysia – Student Menu

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5) A Wiki-Based Approach for Projects Supervision at the University of Mauritius

A dissertation submitted to the CSE department by Yenketeramdoo [5] in 2011 involved a final year project in the form of a web application with a common projects-base for use by supervisors and students, where they could collaborate in a wiki-fashion. The project included the Undergraduate Weight-Based Scheduling Policy to cater for meeting requests sent by students based on factors such as number of tasks completed, number of attended meetings and number of previous meeting requests sent.

6) A Projects Portal at the University of Bradford

In 2011, the School of Engineering, Design and Technology (EDT) from the University of Bradford looked at some of its practices concerning final year projects and investigated best practices to enhance the students' experiences in their final year projects. Pillai [6] has therefore developed an in-house online portal for managing final year projects, be it at the undergraduate level or the postgraduate level.

7) Managing Final Year Projects at the Republic Polytechnic, Singapore

Hadinyoto and Leong [7] from the Republic Polytechnic (RP) School of Information and Communications Technology embarked on a project in 2011, after having acknowledged that final year projects' management had been rather outdated. For the project, freely available project management tools were considered. Redmine had been chosen and adapted to develop a better final year project management system.

8) Final Year Project Management System at the University of Macau, China

FYP MS - Final Year Project Management System, a final year project carried out by Li and Ribeiro [8] in 2012 provided a web platform to manage final year projects at their different stages. The creation of schedules for tasks, using a forum to communicate and tracking the completion of tasks according to approved schedules are the core functionalities that the application offered.

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2.1.1 Critical Appraisal

Project supervision methods used for final year projects not only influence what students ultimately come to deliver, but also how they learn and grow in the process. For the past five years, a number of projects have been undertaken by universities across the world in the area covering project supervision. The projects had been motivated by the assertion that students as well as supervisors could largely benefit from the inclusion of a web platform to manage final year projects.

Although numerous project management tools are readily available, the projects mentioned involved developing custom web applications to accommodate for distributed cross-platform modern development. Most of the studies that have been carried out showed that a web-based environment [1], [2], [3], [4], [5], [6], [7], [8] had been favoured to manage final year projects, albeit each of these adopted different approaches into achieving the same objectives and performing similar tasks. For instance, to manage undergraduate final year projects, Sze [1] concentrated on learning objects and their reuse in other projects while Pillai [6], Marini Abu Bakar et al. [4] and most others opted for an online transformation of their current practices, along with some improvements.

Prior to establishing online project supervision, existing modes of operation had to be investigated. The majority of realised projects are consistent with that of Pillai [6] and Marini Abu Bakar et al. [4] in replacing paper logbooks with an online system while maintaining face-to-face meetings. This is due to the fact that many cases have been identified whereby making project materials available to students online resulted in the latter not wishing to attend project meetings and seeing the online system as substitute.

In these cases it is important for the supervisor to demonstrate that the face-to-face contact time is going to be used to discuss something valuable to supplement and enhance online project supervision. Although such Project Supervision Systems enable everyone to be connected via email, updates, and notifications, developing and maintaining healthy relationships between supervisors and students occur best when done in person, and it is believed that interpersonal relationships greatly help in solving most problems. While most projects have not catered for project meeting scheduling except for Marini Abu Bakar et al. [4], these systems have nonetheless been adopted and proved to be beneficial in yielding better results and enhancing the final year project experience, as evidenced by the operational project portal developed by Pillai. [6]

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2.2 Projects and Project Management

The Project Management Institute (PMI) views a project as "*a temporary group activity designed to produce a unique product, service or result*" and characterises project management as *"the application of knowledge, skills and techniques to execute projects effectively and efficiently*". [9] A project can be said to be a temporary endeavour as it is enclosed within a beginning period and an expected end period to attain a specific result. A team is often delegated to work on the project to reach the final outcome.

2.2.1 Core Functionalities involved in Project Management

- ***File Synchronisation***

A major part of project work is reviewing common documents. Documents are uploaded, listed and become ready for download to all participants. A central repository allows versioning of files and directories. Currently, most project management software support version control systems such as SVN [10] and Git [11].

- ***Task Allocation***

Tasks can be assigned to participants and connected to milestones. This enables phases to be clearly defined and the project status to be tracked against predefined plans. A task assignment system allows tasks to be defined, prioritized and assigned to the appropriate team member.

- ***Communication***

An appointment system with automatic alarms and reminders very often offers an intelligent way to share information, collaborate, and make decisions. For larger projects with complex time-constraints, meeting scheduling is automated using software agents [12]. Storing personal calendars poses potential privacy issues – a group of software agents have thus been delegated this responsibility. All other agents negotiate after an agent proposes a meeting time, which other agents accept, reject or reschedule, based on whether or not it can be accommodated into their own schedules.

2.2.2 Features of Project Management Tools

In the face of technological breakthroughs, the essential project management tools remain unchanged irrespective of industry. The present age discloses diverse sectors such as education and training, production and manufacturing making use of project monitoring tools to handle different types of projects. It is interesting to note that the first project management tool was conceived to schedule and monitor large construction

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projects when Henry Gantt (1861–1919) devised a tool to benefit the shipbuilding industry during the World War I. [13]

In addition to the Gantt chart, two traditional project management tools, the PERT (Program Evaluation and Review Technique) chart and the CPM (Critical Path Method) were developed and are still in use today. The Gantt chart has been refined and is still widely accepted as an important project management tool to graphically represent a project's schedule and progress.

Project management software typically possesses some features that can be categorised and are thus described as follows:

Team Building

- ***Users and Roles*** – Users having roles assigned to them can be created. The roles are associated to users to differentiate between team members and managers.

Project Planning

- ***Project Creation*** – projects can be created and managed.
- ***Use of Gantt Charts*** – to plan the projects flows through task schedules.
- ***Work Breakdown Structure (WBS)*** – projects can be broken down into smaller and more manageable subparts.
- ***Task Allocation*** – the WBS can be used to allocate tasks to team members.

Scheduling and Tracking

- ***Calendars and Meetings*** – meetings can be scheduled based on the availability of team members.
- ***Progress Charts*** – based on the tasks assigned to team members, project completion can be tracked and progress charts can be generated.
- ***Reporting*** – details about progress can be communicated using reports.

Document Sharing

- ***Version Tracking*** - tracks and logs all uploaded documents related to the project as they evolve over time.
- ***Document Comparisons*** – checks documents and highlights the changes made. Changes can be rejected or accepted and documents can then be merged into coherent ones.
- ***Centralised Documents Base*** – a single access place for all documents.
- ***Documents Archiving*** – after projects have been completed, they can be moved to another place for archiving purposes.

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Collaboration

- ***Email Notifications*** – e-mails can be sent to team members as a means to collaborate on projects tasks.
- ***Discussions and Feedback*** – feedback can be left for particular tasks and discussions can be open to solve problems that may arise.

Security

- ***Personal Dashboards*** – project managers are presented with a dashboard which allows them to see the progress of several projects being monitored.
- ***Views*** – the views associated to different roles differ due to the levels of information required by the different parties involved.

2.2.3 Types of Project Management Tools

Project management software can be categorised as desktop applications or web-based applications and their license can be open source or proprietary.

Desktop-based or window-based project management software is one that runs on the users' computers and has its data stored locally in a file. Although the desktop-based application provides the user with a highly responsive interface, the data can be accessed by only one person at a time even if the shared data resides on a network's central database. [14] It tends to respond quickly to users actions and requests, but if a project involves several people to collaborate, then the software would be disadvantageous.

Alternatively, web-based project management software supports multiple users and is accessible over an intranet, an extranet or the Internet using a web-browser. The web application is platform-independent and does not require any installations on clients. However, this type of application is likely to have a slow response. [14] While web-based applications only involve installing a single version of the software on the server and all clients making use of it, they are usually constrained by users' connection speed.

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2.2.4 Comparison of Project Management Tools

			License	Deployment	Project Management	Document Management	Collaboration	Security	Help & Support
1	Project Foundry [15]	ProjectFoundry	Proprietary	Web-based	✓	✓	✓	✓	✓
2	MPMM Educational [16]	MPMM™ Educational	Proprietary	Desktop-based	✓	✓	✓	✓	✓
3	Microsoft Project [17]	Microsoft Project	Proprietary	Desktop-based	✓	✗	✗	✓	✓
4	Celoxis [18]	CELOXIS	Proprietary	Web-based	✓	✓	✓	✓	✓
5	Gantt Project [19]	GANTT project	Open Source	Desktop-based	✗	✗	✓	✓	✓
6	OpenWorkbench [20]	OPEN WORKBENCH	Open Source	Desktop-based	✗	✗	✗	✓	✓
7	Redmine [21]	REDMINE	Open Source	Web-based	✓	✓	✓	✓	✓
8	TaskJuggler [22]	TaskJuggler	Open Source	Desktop-based	✗	✗	✓	✓	✓
9	Project.net [23]	project-net	Open Source	Web-based	✓	✓	✓	✓	✓
10	dotProject [24]	dotProject	Open Source	Web-based	✓	✓	✗	✓	✓

Table 1: Comparison of Project Management Tools

From *Table 1* it can be observed that some project management software offer the core functionalities, such as project management, document management, planning and scheduling of resources, as well as collaboration and security. MPMM Educational and Project Foundry offer project management facilities on a licensed fee and are mainly employed in the educational sphere. The latter are more adapted to the needs of lecturers and students in universities and colleges while most other project management applications suit the requirements of business companies. In addition, web-based open source software like Redmine allows wikis and revision control management (SVN, CVS, Git, Mercurial) integration, and these features are not found in similar tools such as dotProject.

Project management, thus, allows users to define rules for their activities. [7] Project managers are able to plan a project from start to finish with the use of appropriate tools in order to submit deliverables in time. Final year projects can be managed in much the same way as companies go about managing their projects, although the final year project occurs on a smaller scale and is generally less resource-intensive.

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2.3 Project Management for Educational Purposes

This section sets the scene by introducing Project-Based Learning (PBL). A brief discussion of Final Year Projects (FYPs) as PBL follows, while the remaining parts of this section respectively describe the types of students that undertake Final Year Projects and Project Management in the Final Year Project context.

2.3.1 Project-Based Learning (PBL)

Learning is the process whereby knowledge is created through the transformation of experience. [25] Learning-by-doing has always been attributed importance because it not only enables the learner to assess what they are up to and be logical in their decisions but also helps them to perceive a considerable increase in what they already know.

The Buck Institute for Education (BIE) defines project-based learning as a process whereby:

> *"...students go through an extended process of inquiry in response to a complex question, problem, or challenge. While allowing for some degree of student "voice and choice," rigorous projects are carefully planned, managed, and assessed to help students learn key academic content, practice 21st Century Skills (such as collaboration, communication & critical thinking), and create high-quality, authentic products & presentations."* [26]

PBL, as opposed to the traditional way of learning (instructor-centric [27]), presents students with a real-world problem and they independently explore the solution domain. Students learn by applying their knowledge to solve a practical problem with the guidance of a lecturer. The students' knowledge is tested and by interacting with other people new knowledge is constructed and new skills are acquired.

2.3.2 Final Year Projects (FYPs) as Project-Based Learning (PBL)

The final year project is an opportunity for students to gain experience by effectively applying what they have been studying for the past two years and also to learn to lace their conceptual knowledge with clever judgement.

The final year project exhibits PBL properties and the benefits associated to PBL of imparting students with 21st Century Skills are closely linked to those of final year projects.

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Such constructivist learning environments allow for interoperable resources across different projects. Since project supervisors often wish to reuse learning resources based on particular situations and students, the methods of PBL with learning objects can be applied to FYPs. In fact, a final year project carried out by Sze [1] involved this practice.

2.3.3 Types of Students and Project Supervision

Different students tackle their projects differently – some start early and are able to deal with issues better while others may find it difficult to plan their work right from the beginning. Malik [2] states that it is necessary for supervisors to devise ways to cater for these differences, even though it can prove to be difficult to identify the differences in the first place. This is due to the fact there exists different types of students and they can be categorised as follows:

- *Independent* – such students are ready to embark on the project early with much enthusiasm and need little supervision.
- *Collaborator* – this group of students actively seek guidance in areas in which they find difficulties and continue on their own as soon as the supervisor has shed light on the topics.
- *Poser* – students found in this category pretend to be enthusiastic about their project when in fact they require a substantial amount of supervision.
- *Dependent* – such students rely heavily on the supervisor for much of their work.

However, they do not permanently remain in a particular category throughout the project's lifecycle. [2]

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2.4 Potential Implementation Tools and Technologies

2.4.1 Databases

Information about students, supervisors, projects need to be kept in a database for ease of storage and retrieval. The following databases can be considered for implementation.

- Microsoft SQL Server [28] Standard offers proprietary advanced features such as data analysis targeted to large-scale applications.
- MySQL [29] is a popular open-source database choice for web applications. It provides scalability and flexibility given that all types of Windows, Linux and UNIX operating systems are supported.
- PostgreSQL [30] offers open-source advanced features with high reliability even when it concerns large volumes of data and a large number of concurrent users.

2.4.2 Development Framework

Web technologies can be considered to implement the system to allow ease of access to all stakeholders. HTML, AJAX, JSON and JavaScript libraries can be used in combination with one of the following server-side scripting languages for development.

- ASP.NET [31] is a server-side technology based on the Microsoft .NET Framework that offers a choice between a number of object-oriented programming languages, of which Visual Basic .NET and C# are the most popular for developing web applications.
- Java Server Pages (JSP) [32] technology enables web-based, platform-independent application development. JSP technology separates the user interface from content generation, enabling changes to be made to the layout without altering the underlying process.
- PHP: Hypertext Preprocessor (PHP) [33] is a scripting language that is widely used for dynamic web pages development. PHP provides the freedom of choice of operating systems and web servers. It allows for procedural programming or object-oriented programming (OOP) [34], or a mixture of both.

The above-mentioned languages additionally support the Model-View-Controller (MVC) [34] architecture. The idea behind the MVC architectural pattern is to have the following clearly separated in an application:

- Data handling and business logic - ***Model***
- Information presentation to the user - ***View***
- Response to the user's requests and appropriate call to resources to handle data and present information - ***Controller***

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2.4.3 Data Visualisation

Data visualisation is important to communicate information clearly and effectively. Progress of all projects and Gantt Charts of individual projects can be visually represented based on stakeholders' information requirement. The following can be considered to achieve the previously-stated purpose.

- Google Chart Tools [35] provide data visualisation by using a common JavaScript DataTable class. This class exposes methods for sorting, modifying, and filtering data. A DataTable can be populated programmatically from data retrieved from a database, or from data requested from a data provider supporting the Chart Tools Datasource Protocol. Several chart types ranging from simple bar charts to complex dashboards can be created.
- ExtJS Charts Package [36] provides the capability to visualize data by directly binding the chart to a store thereby enabling automatic updates, since the store is tied to a model which is in turn bound to a controller. ExtJS Charts Package includes bar charts, line charts, pie charts, radar charts, gauge charts, among others.
- JpGraph [37], a PHP charting library allows automatic, web-friendly, generation of client side image maps to produce precise graphs. It has a detailed documentation with tutorials and an extensive class reference. It supports several plot types including spider-plots, pie-charts, Gantt Charts scatter-plots, line-plots, bar plots and counting.

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CHAPTER 3 – ANALYSIS

Final Year Projects (FYPs) are undertaken by students in their final year of study from all the faculties across the University of Mauritius. Most of the courses comprise a final year project which forms an essential part of the degree requirements not only in the importance it is given for the associated weightage or the marks allocated but also as a highly valuable learning experience.

The final year project is important for the acquisition of a bundle of skills which would otherwise be more difficult for the student to get hold of. It aims at imparting the student with skills such as independent learning, developed maturity and critical thinking among other lifelong learning skills.

Projects are usually carried out in groups of two students and supervised by members of the academic staff who may themselves be interested in similar research areas. Throughout the project, students work collaboratively and seek guidance from the assigned supervisor. Thus, to enhance the final year project experience for both the supervisor and the project students, it is important to closely monitor the project's process to allow the successful completion of same.

3.1 Data Gathering

Five lecturers had been contacted and they willingly shared their experiences concerning final year projects. Similarly, around fifteen project students were as eager to provide their views on their final year project exposure. (See Appendix B for interview questions) The encounter with students had been rather informal for the author herself is a project student. Current practices have been under close observation and the findings have been thoroughly analysed. Through the interview and observations, the different inefficiencies and problems associated with the project supervision process were uncovered as described in the sections that follow.

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3.2 Current Practice

3.2.1 Project Supervision

The Computer Science and Engineering (CSE) Department allows students to either come up with a project proposal or to choose from a list of 10 projects proposed by lecturers, one of which is eventually be assigned to them.

Projects are carried out individually or in groups of maximum three students under the supervision of academic staff members. In the event of multidisciplinary projects, these may be handled by a number not exceeding two supervisors. [38]

After the allocation of projects, students are required to contact their supervisors regularly to discuss the progress of the project - usually weekly meetings or fortnightly meetings occur. Milestones are described and deliverables are expected at set deadlines.

The progress log is filled after each meeting. Upon the submission of deliverables, the supervisor provides oral feedback as well as written comments on the work submitted.

Any change or advice suggested is brought as early as possible for the supervisor to check so as not to cause much hindrance to the project's progress.

3.2.2 Roles and Responsibilities

The Student

The student occupies the lead role in the realisation of the project. Prior to the start of the project the student is responsible to contact the supervisor as early as possible for guidance. He also accepts the responsibility of maintaining contact with the supervisor according to a regular meeting schedule. The student is the one who takes the initiative to work and write up the report.

The Supervisor

The supervisor functions as a director and steers the project in the correct directions. According to Caulfield [39], the supervisor's role is triple-faceted: he functions as a consultant, as an invigilator, and also grades the project at the end. One of the important responsibilities of the supervisor is to ensure that the student is on the right track by providing valuable support and advice.

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The Project Coordinator

The project coordinator allocates projects based on the priority set by the students. Any issue regarding the project that is out of the scope of the supervisor's responsibilities is addressed by the project coordinator.

The Second Marker

The second marker is unbiased about the work that has been done during the year and grades the project accordingly based on what has been produced. The project is subjected to double blind marking where the second marker and the supervisor usually agree on the mark to be awarded to the student.

The External Examiner

The external examiner audits the process to ensure that marks awarded are consistent with the qualification awarded by other institutions. The external examiner randomly selects a number of projects and reviews them. If any project has received highly uneven marks, a more thorough examination is conducted.

3.3 Problems with the Actual System

A number of supervisors and project students from the CSE department have been interviewed to gather information about the final year project supervision process.

3.3.1 Inadequate Progress Tracking

The progress log offers no concrete way for supervisors to monitor a project's real progress as there are no visual depiction of the work that has already been completed, the actual work, what remains to be done and whether the work has been completed in time. Interviews with supervisors revealed that most of the time when it is already quite late that it becomes apparent how far behind the students are lagging.

3.3.2 Inefficient Progress Reporting

The progress log does not suffice in keeping a record of the progress and reporting it efficiently. It merely consists of a table to enter the number of project meetings, the date of the meeting, the topics discussed and comments from the supervisor along with his initials and that of the student.

From the interviews with both supervisors and students, it can be figured out that both parties are able to have an idea of the progress only during project meetings. At a glance, the progress log does not expose for how long there has not been any project

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meeting, since the progress log is filled only when meetings are conducted. Furthermore, during project meetings, very often students as well as supervisors, neglect the progress log which is rarely filled, if at all, to be easily faked at the end.

3.3.3 Flawed Project Appointments

Most meetings are currently set up via email or text messages and the supervisor has to deal with a lot of impromptu meetings, if not recurring ones. It has been seen that during the early stages of the project, students do not feel concerned about meeting the supervisor regularly. It is only when the submission date is near that most students come to realise that there is a lot of work left to be done and wish to meet the supervisor as often as possible. This not only increases the workload of the supervisor but the latter is unnecessary stressed as well, given his already tight schedule. When asked about the particular phenomenon, students voiced out that they are not aware of what is expected of them early in the project, therefore they tend to avoid the encounter with the supervisor, which all the more hinders the whole process.

3.3.4 Sceptical Project Supervision

From the interviews conducted, it can be deduced that each supervisor has his own way of dealing with project students. The methods employed by supervisors to set meetings are an example whereby some prefer weekly meetings while others prefer fortnightly ones. Apart from the frequency of project meetings, another example would be the amount of support provided by supervisors to students. Although the methods used by supervisors happen to be adequate in practice and have been successful over the years, there are still different types of students who work at different paces which the current system does not take into consideration and eventually makes project supervision quite cynical.

3.3.5 Unenthusiastic Experience

The problems stated, when brought together, form an unenthusiastic experience which many wince and frown upon as soon as final year projects are mentioned. Contrary to what should have been an enriching experience, whereby many things are learnt, new horizons brighten up for the student as well as the supervisor when a diverse pool of students and competencies are known, the final year project is sadly viewed by many as an ordeal.

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3.4 Functional Modelling of Actual System

Use Case Diagram – Project Supervision Process

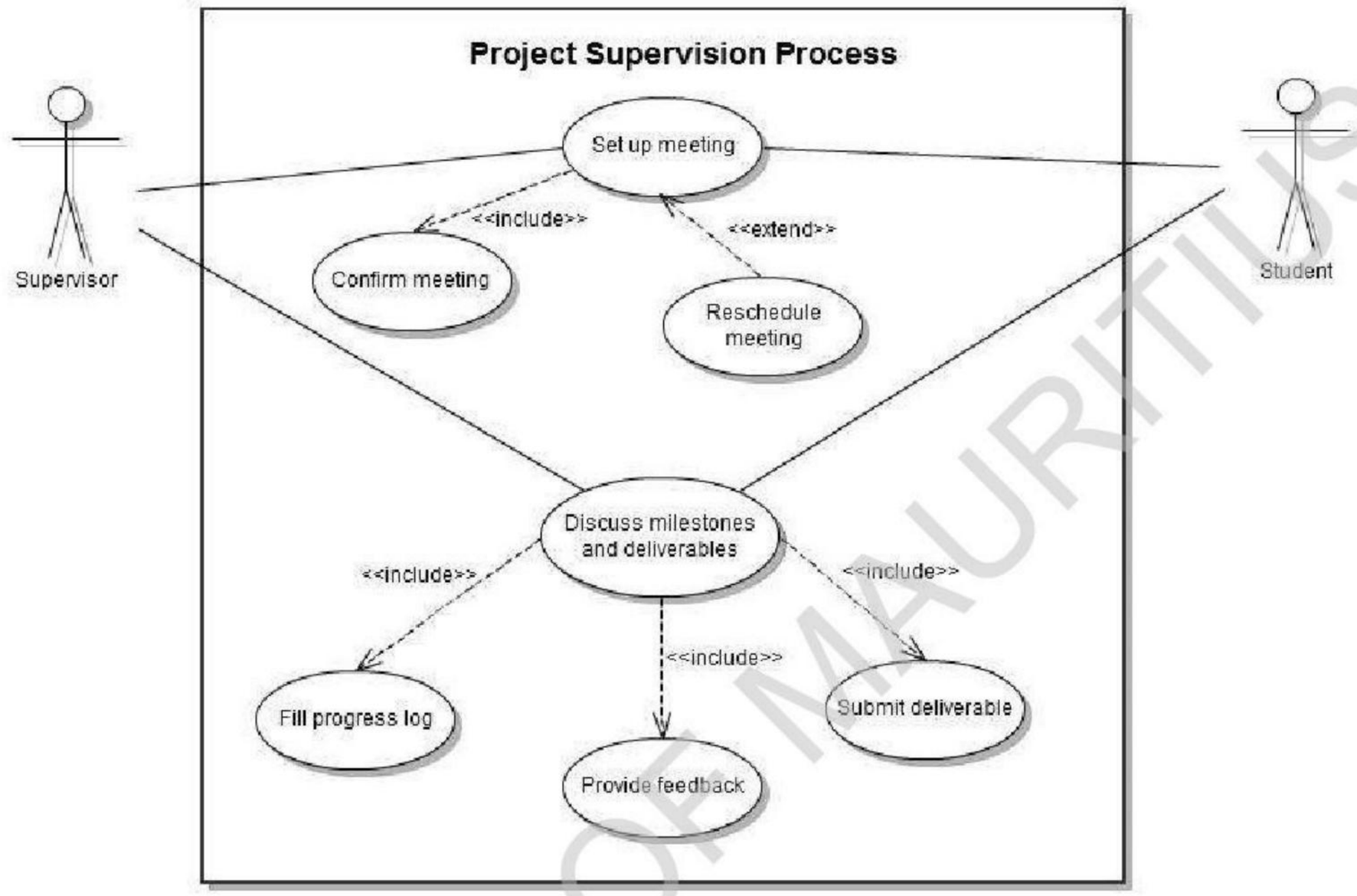

Figure 4: Use Case for Current Project Supervision Process

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3.5 Requirements Specifications

3.5.1 Functional Requirements

- Project Supervision

Requirement ID	***Description***
FR1	The proposed system shall allow for a web-based platform for supervisors to monitor final year projects.
FR2	Supervisors shall be provided with facilities such as project and appointment scheduling to enhance the supervision process.
FR3	Students shall be able to upload files for the different tasks that they have been assigned to by the supervisor.
FR4	Supervisors shall be able to download files that have been uploaded by students for the given tasks.

- Progress Tracking

Requirement ID	***Description***
FR5	The system shall allow for a Gantt chart feature for supervisors to track projects' progress and update the percentage progress accordingly.
FR6	Using the system, students shall be able to view their current progress percentage.

- Progress Reporting

Requirement ID	***Description***
FR7	A Gantt chart feature shall allow for progress to be reported to both supervisors and students.
FR8	The system shall provide supervisors with facilities to add, edit and delete comments for the works submitted by students.
FR9	The system shall allow students to view supervisors' comments for the tasks they have submitted.

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- Meeting Scheduling

Requirement ID	***Description***
FR10	The system shall allow for project meetings to be set and recorded.
FR11	Supervisors shall be able to announce meetings, accept, decline or reschedule appointments that are received.
FR12	Students shall be able to request meetings and wait for supervisors' approval, after which they should be notified by email.

3.5.2 Non-functional Requirements

- Access and Security

Requirement ID	***Description***
NFR1	The system shall allow for four levels of access, namely students, supervisors, project coordinators and administrators with the latter detaining the highest level of access.
NFR2	The system shall provide for different views and level of security depending on the access level.
NFR3	The system shall make use of appropriate authentication methods for the different user categories for them to login unto the system.

- Usability

Requirement ID	***Description***
NFR4	A simple and intuitive user interface shall be provided for the users of the system.
NFR5	Friendly error messages and guidelines shall be displayed to allow users to navigate the system in most efficient ways.

- Integrity

Requirement ID	***Description***
NFR6	The tasks uploaded by a particular student shall be correctly

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	identified.
NFR7	The comments of the supervisors for a given tasks shall not be tampered with.
NFR8	Supervisors shall be able to add comments, edit and delete comments while students shall to be able to only view the feedback received.

- Scalability

Requirement ID	***Description***
NFR9	The system shall be structured so that it can be easily extended to accommodate more users and new categories of users without having to make major changes to the existing structure.

Use case – Proposed Project Supervision System

The Proposed Project Supervision System is divided into three subsystems, namely:

a) Appointment Subsystem

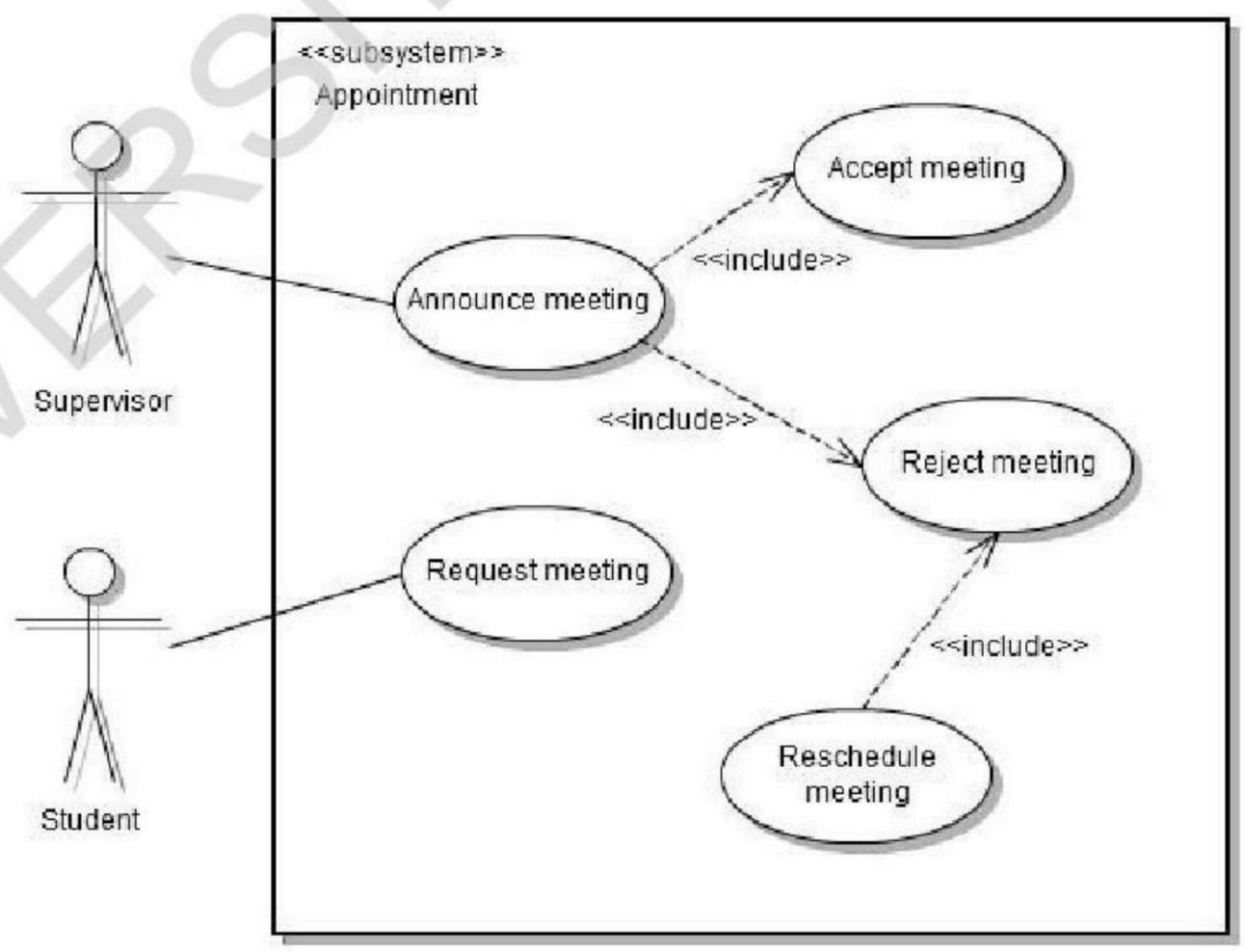

Figure 5: Use Case for Proposed Project Supervision System – Appointment Subsystem

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b) Document Management Subsystem

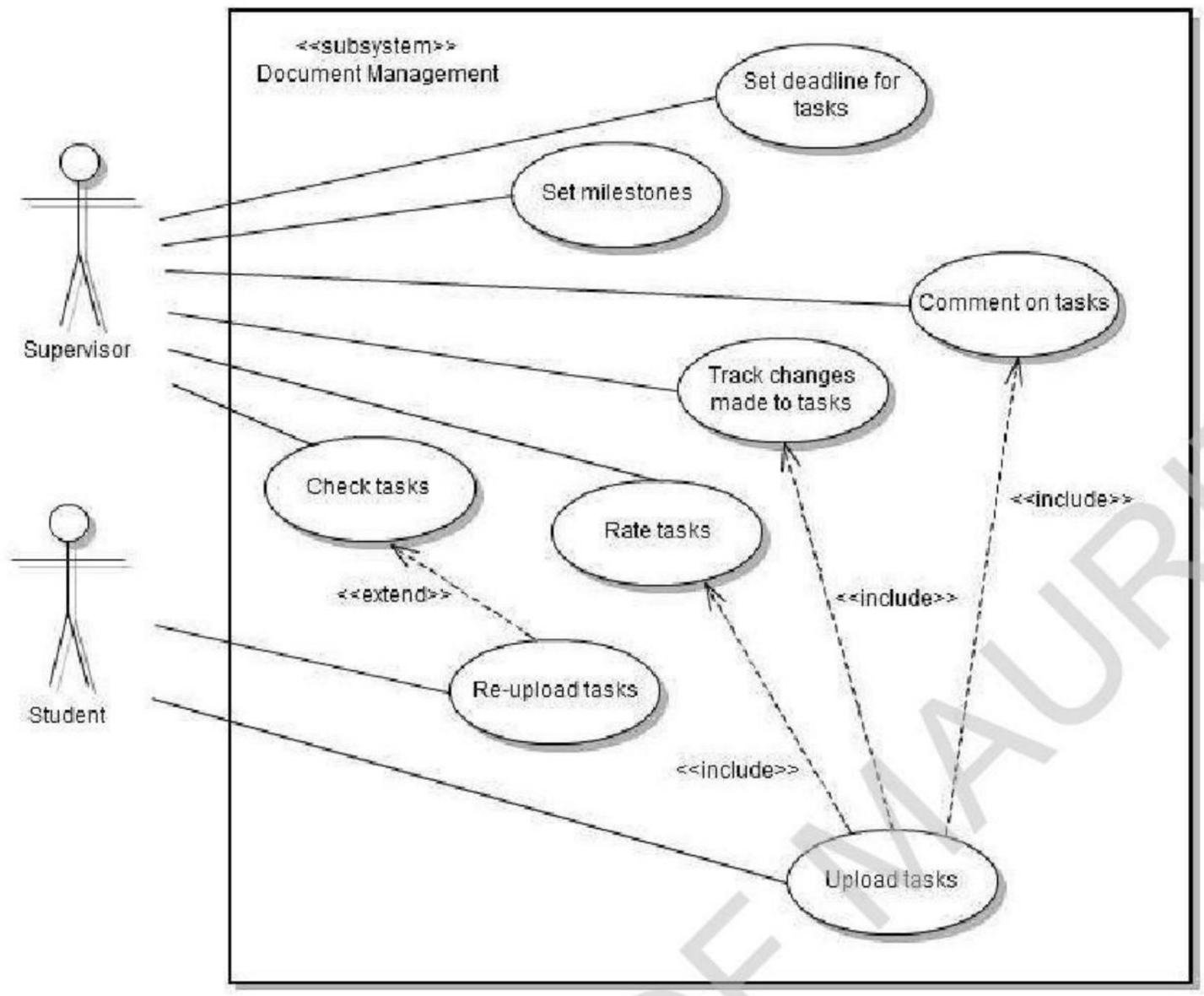

Figure 6: Use Case for Proposed Project Supervision System – Document Management Subsystem

c) Project Management Subsystem

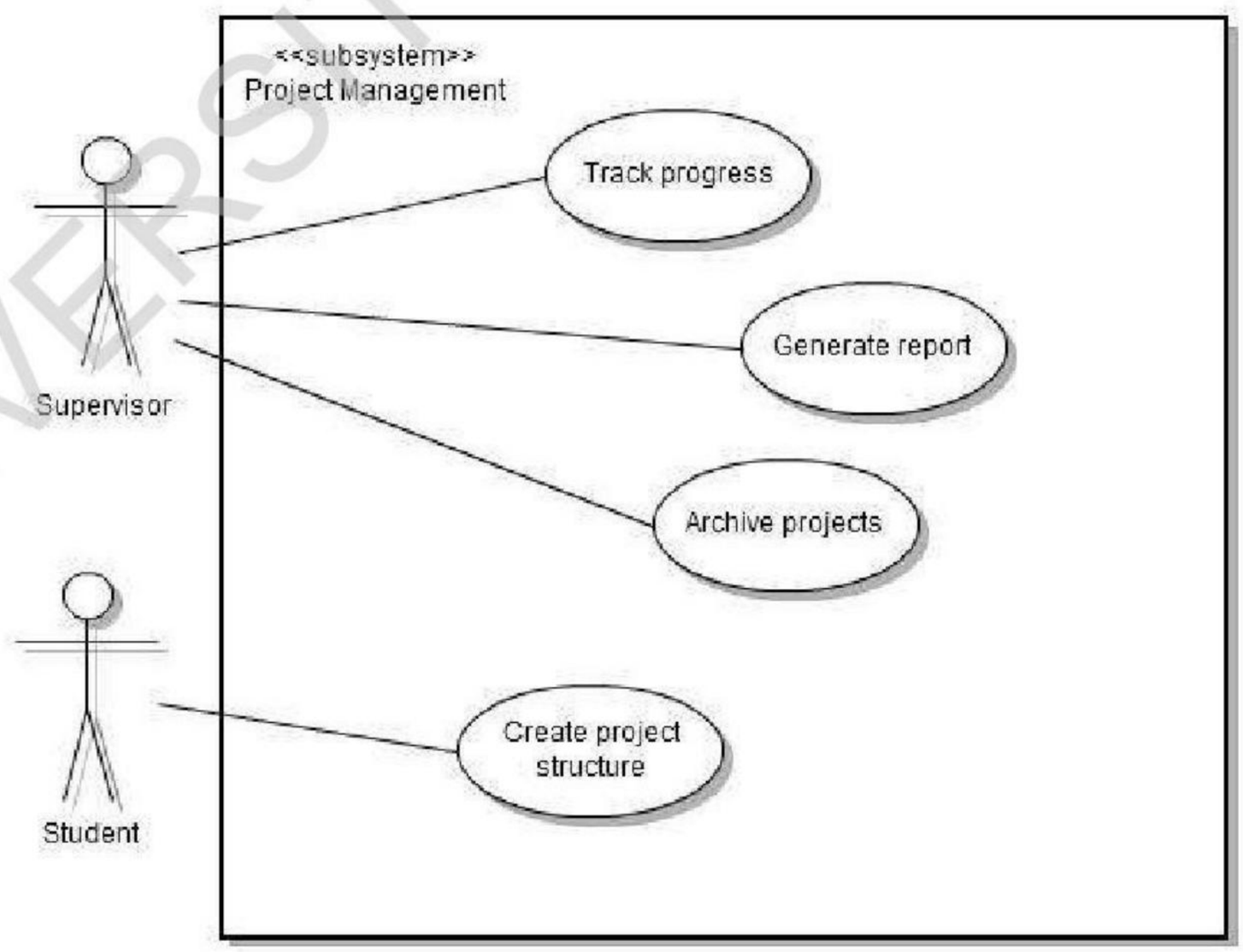

Figure 7: Use Case for Proposed Project Supervision System – Project Management Subsystem

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3.6 Alternative Solutions

1. Replacing the paper progress log with a logbook.

Logbooks could be kept by each student in which additional notes about what has been discussed during meetings as well as any other research work pertaining to the project are taken. Eventually, it could be checked and duly signed by both the supervisor and the project coordinator at predefined intervals and submitted along with the dissertation.

Pros: The logbook could be used to identify learning processes and to keep a record of the efforts related to the final year project planning and tasks carried out. It would not only provide a record but also a means of securing action and planning ahead. Furthermore, it would imply that there is better control of what the student is working on and what is being discussed by the supervisor. At the same time, it would offer a better way to track the project's progress.

Cons: It would still be a time-consuming process – in this case it could very well worsen the actual situation since a large number of project students are involved and the project coordinator would have to spare much time only for this purpose.

2. Use of existing project management tools.

Project management software comes in various types - be it open source or commercial, desktop-based or web-based. Accomplishing a number of projects entails taking into account the requirements and constraints of the projects involved which can be difficult without an appropriate tool. In such situations, project management software becomes handy in supporting the effort to complete projects in time.

Pros: Project management software is readily available off-the-shelf and allows passing through critical steps involved in any project, and are generally more efficient than using generic software such as a calendar or spreadsheet.

Cons: The majority of users are seen to be using only very few of the many features of project management tools. Under these conditions this software could become be too expensive for most small and medium sized projects.

Some tools are designed strictly to provide particular functions, hence making them more adept for certain activities. It is not feasible to purchase widespread commercial software only to use some modules.

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3. Developing a desktop-based system.

Developing a desktop-based system would be fairly easy and less time-consuming. Although a desktop-based system would have been appropriate to manage a small number of projects involving few users, it would not totally solve the problem in the long run.

Pros: It is simple and easy to use and faster to develop. A desktop-based system is responsive and usually has users more engrossed, hence makes them want to use the system.

Cons: Deployment and upgrades are time-consuming processes since they would have to be done on each and every machine. Using desktop software to manage projects poses a challenge in that such applications were not initially designed for collaboration among several users. At worst, a file is shared by email to all parties on the team and at best, the file may be shared on a network.

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3.7 Proposed Solution

3.7.1 Project Monitoring Tool for Supervisors

A web-based system is intended as solution to address the challenges posed by the current project monitoring practice. Face-to-face meetings will be maintained alongside the proposed online system to have an enhanced supervision process, while appointments are going to be scheduled in ways to ensure more equitable practices. The supervisor will be able to set available time slots and taken up time slots. Students can request for appointment slots after checking if the supervisor is free at specific times. After verifying the requested appointment time, the supervisor will be able to accept, decline or reschedule meetings.

Operations such as create, read, update and delete tasks will be web-based and are going to be executed on an intuitive user interface. Tasks with predefined start date and end date can be created, and modified accordingly. Students are going to be able to upload files under the tasks assigned. After tasks have been uploaded, the supervisor will be able to download, check and comment on the work submitted. If the work entails a re-submission, the supervisor will be able to provide feedback, which when the student is able to view, the latter is able to make the necessary amendments. When the student re-uploads the work, the file will be renamed so that the original is not overwritten.

Data visualisation, in the form of charts will illustrate information that would otherwise be more difficult to interpret. A Gantt Chart will be provided to reflect the tasks being carried out and the progress of each task. Supervisors are going to be able to update the start date, end date and percentage completion of each task which are going to be reflected on the Gantt chart. Students, on the other hand will be able to view their tasks and the percentage completed. Information related to projects will therefore be constantly available to all parties involved. Additionally, students will be more motivated to carry out the project as a result of the accumulated feedback for each work submitted.

This method of presenting information to the users will greatly influence the way project supervision is carried out seeing that stages in the projects' development are closely monitored and areas of concern are identified in time.

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3.7.2 Category of users in the Proposed System

Administrator	The administrator is responsible for creating accounts for other users and to reset the database after each academic year.
Project Coordinator	The project coordinator assigns projects to students depending on the courses for which supervisors have proposed projects.
Supervisor	The supervisor monitors the student's work and comments on the same so as the project moves forward. He sets available time slots for meetings to be conducted regularly.
Student	The student has the responsibility to attend project meetings after making requests and submit tasks at set deadlines.

Table 2: Stakeholders in the Proposed System

3.7.3 High-Level Architectural Diagram – Proposed System

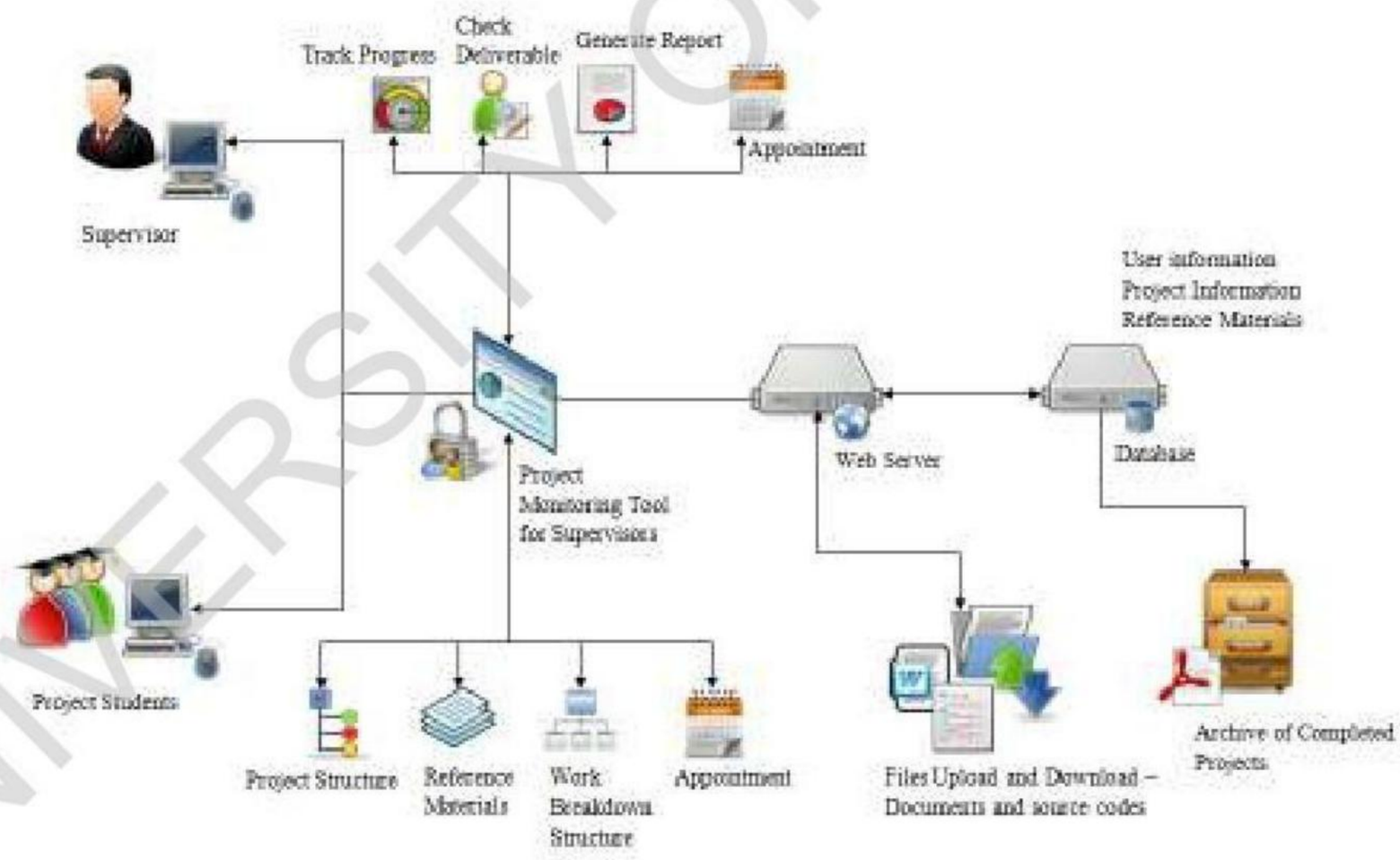

Figure 8: High-Level Architectural Diagram of Proposed Project Supervision System

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3.8 Evaluation and Choice of Tools for Implementation

3.8.1 Databases

For the purpose of this project, a small scale application is going to be developed and the choice of database is influenced by its requirements. Therefore, PostgreSQL is not being taken into account for its advanced features are most suited to production-quality web applications. Microsoft SQL Server is not being considered due to the associated license and cost. MySQL, on the other hand, is most adopted for web applications given its ease of use and is hence being favoured over Microsoft SQL Server and PostgreSQL. Also, the existing exposure and familiarity of the developer to one particular database far outweighs the differences that exist between MySQL, PostgreSQL and Microsoft SQL Server.

3.8.2 Development Frameworks

PHP has been the chosen server-side scripting language as it is suitable for sites which do not need to be backed by a full-featured framework. Deployment with PHP is relatively easy and is supported by almost every web host. Also, the present experience of the language compared to programming with JSP or ASP .NET pages using either VB .NET or C# will be an advantage for the development process.

3.8.3 Data Visualisation

JpGraph has been opted to represent information graphically. Since PHP has been chosen to develop the system, JpGraph is appropriate in the sense that it is a PHP charting library and also supports Gantt Charts. This is an advantage over using other libraries where Gantt charts are not primarily found and bar charts would have to be used to produce Gantt charts.

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CHAPTER 4 – DESIGN

Based on the requirements identified in the analysis stage, this chapter presents the solution plan in the form of an architectural view of the system along with a description of the components and their behaviour. It includes database design, interface design and the algorithms that are going to be used.

4.1 Design Concerns

4.1.1 Software Design Approach

A combination of top-down and bottom-up approaches is going to be used to reap the benefits that both methods offer. Top-down allows for a global understanding and planning of the system while bottom-up enables early coding and testing, as soon as the first component has been identified.

4.1.2 Modularity, Reusability and Portability

The independent components of the proposed system are going to be implemented in isolation before being integrated into the desired application. The web-based nature of the system already implies cross-platform performance.

4.1.3 Quality of Service

The intended solution is expected to improve the supervision process by closely monitoring the project progress and providing timely feedback. Basic existing data is going to be organised and transformed into valuable information to be used by stakeholders. As a result, the final year project experience for supervisors and students is going to be enhanced.

4.1.4 Error, Exception Handling and Fault Tolerance

It is common to show friendly error messages to the user to handle situations which are unlikely to occur. However, for critical situations it is not feasible to only display an error message. Several exceptional conditions that may cause the system to break down are going to be anticipated during the design and defence against these are going to be incorporated for a more dependable system. Thus, if exceptions are handled properly, a robust and fault-tolerant system is going to be in place.

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4.1.5 Security

The system is going to cater for an equitable security level by providing different views for the user categories involved. Access to system functionalities will depend on user roles. Four categories of users and access levels have been identified:

1. *Administrator*
    - Creates account for project coordinators
    - Delete account for project coordinators
    - Reset password for project coordinators
    - Assign a project coordinator for each course
    - Sets the current year for project allocations
    - Manages the database

2. *Project Coordinator*
    - Creates account for supervisors
    - Deletes account for supervisors
    - Resets password for supervisors
    - Allocates projects to students

3. *Supervisor*
    - Add new projects into the system
    - Manages projects and students
    - Creates tasks and reviews students' work
    - Monitors each project's progress
    - Provides feedback on students' work
    - Communicates with student
    - Makes available to students free time slots for meetings
    - Accept/Decline meeting requests

4. *Student*
    - Uploads files
    - Views progress
    - Communicates with lecturer
    - Send project meeting requests

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4.2 Conceptual Design

To come up with the conceptual design of the Project Supervision System, three main investigations have been carried out. Firstly, the features and functionalities of project management software readily available on the market have been examined. Secondly, a set of research papers pertaining to final year project supervision have been reviewed. Thirdly, projects dealing with project allocation, monitoring and submission by previous students from the CSE department have been consulted.

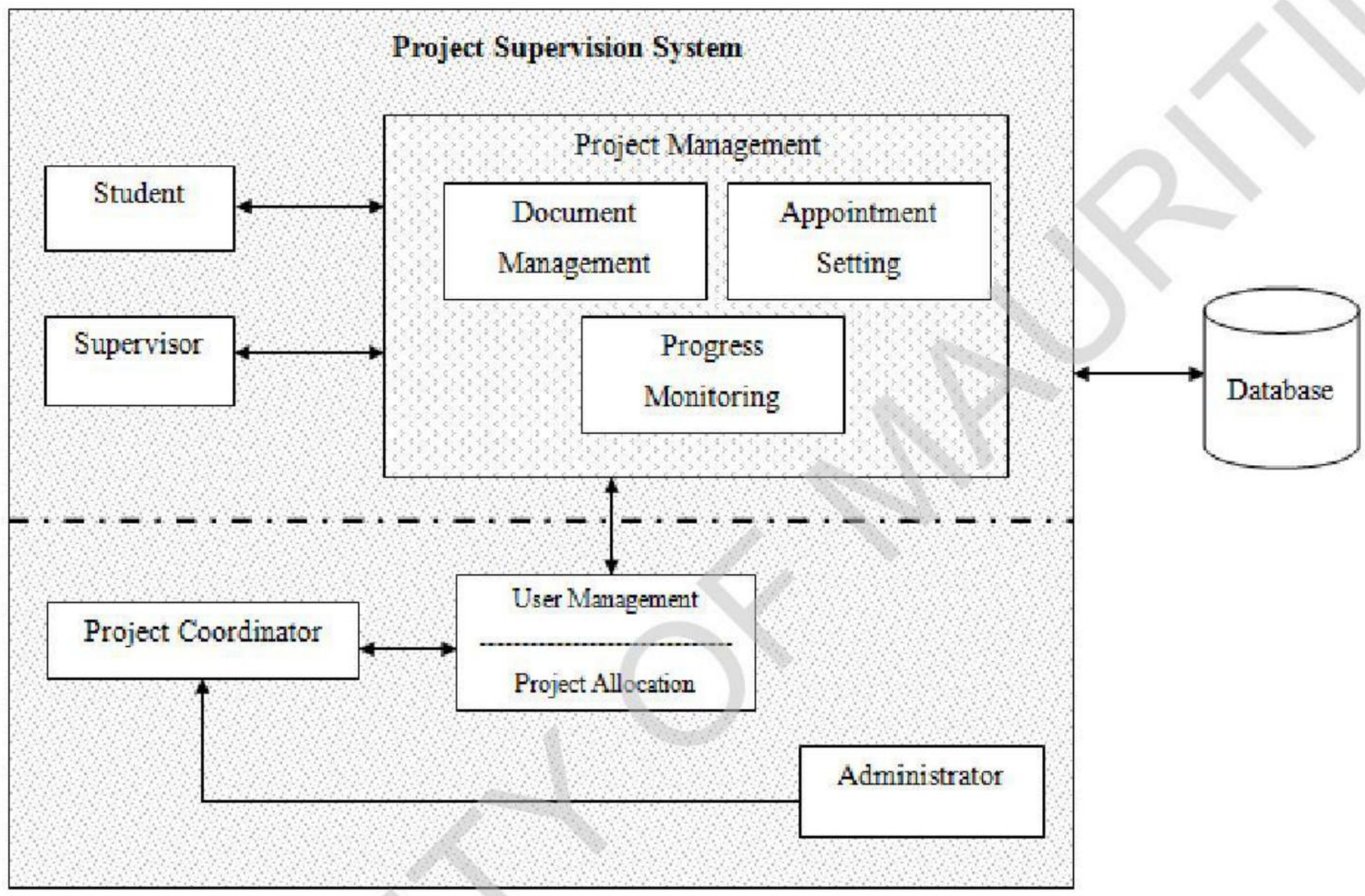

Figure 9: Conceptual Design of the Project Supervision System

4.2.1 Description of Modules

To improve the existing manual project supervision process, a few important modules for the Project Supervision System have been identified.

Users of the system are administrator, project coordinators, supervisors and students. The modules are:

1. Administrator module
   a) Assigning project coordinators to courses
   b) Account creation for project coordinators
   c) Account deletion for project coordinators
   d) Password reset for project coordinators
   e) Database management

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2. User Management module
   a) Account creation for supervisors
   b) Account deletion for supervisors
   c) Password reset for supervisors
3. Project Allocation module
   a) Allows projects to be allocated to students by project coordinators
   b) Each course has one project coordinator to do the allocation process
   c) Allocated projects can be de-allocated if the need arises
4. User Account module
   a) Records the most updated users' information such as the first name, last name and password.
   b) All users can update their information.
   c) Users can change their passwords
5. Document Management module
   a) Allows supervisors to set tasks
   b) Allows students to upload documents
   c) Allows supervisors to download documents
   d) Allows supervisors to comment on the work submitted
   e) Allows students to view the comments from the supervisor on the work submitted
6. Progress Monitoring module
   a) Allows the supervisor to set the system development schedule
   b) Supervisor can monitor student's progress based on the work submitted. Status of all projects' progress can be displayed so that the overall progress is viewed by the supervisor.
7. Appointment Setting module
   a) Student can send appointment requests
   b) Supervisors can accept or decline request
   c) Accepted appointments can be displayed on the supervisor's calendar and other project students can see the taken up time slots before making appointment requests.

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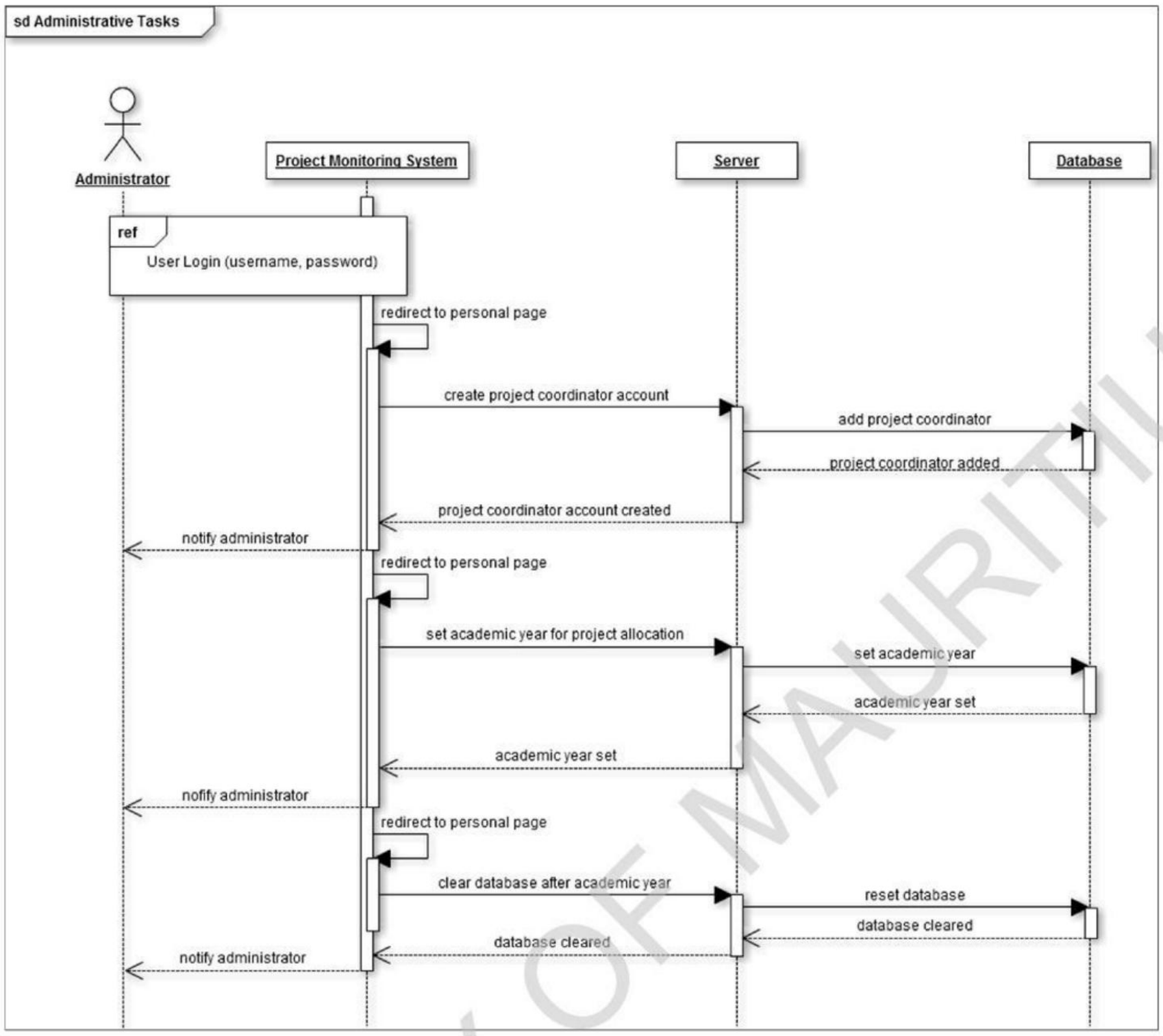

Figure 11: Sequence Diagram – Administrative Tasks

The administrator will be required to manage accounts for project coordinators, set the academic year for project allocations and also to manage the database.

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4.3 System Modelling

1. Sequence Diagrams

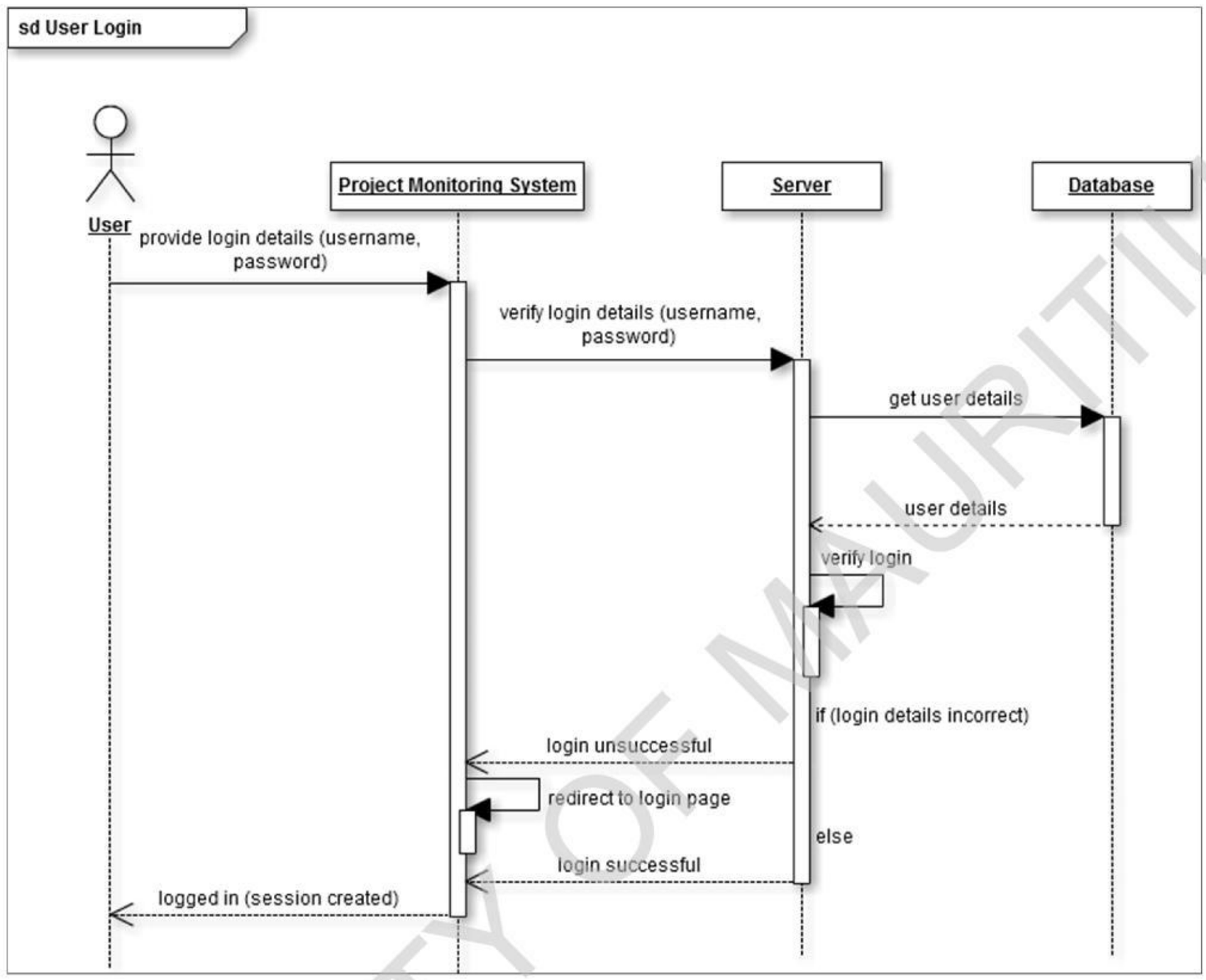

Figure 10: Sequence Diagram – User Login

All members will be required to login to access the system. Users will be required to provide login details, such as username and password for authentication after which the user is redirect to a personal area based on his credentials.

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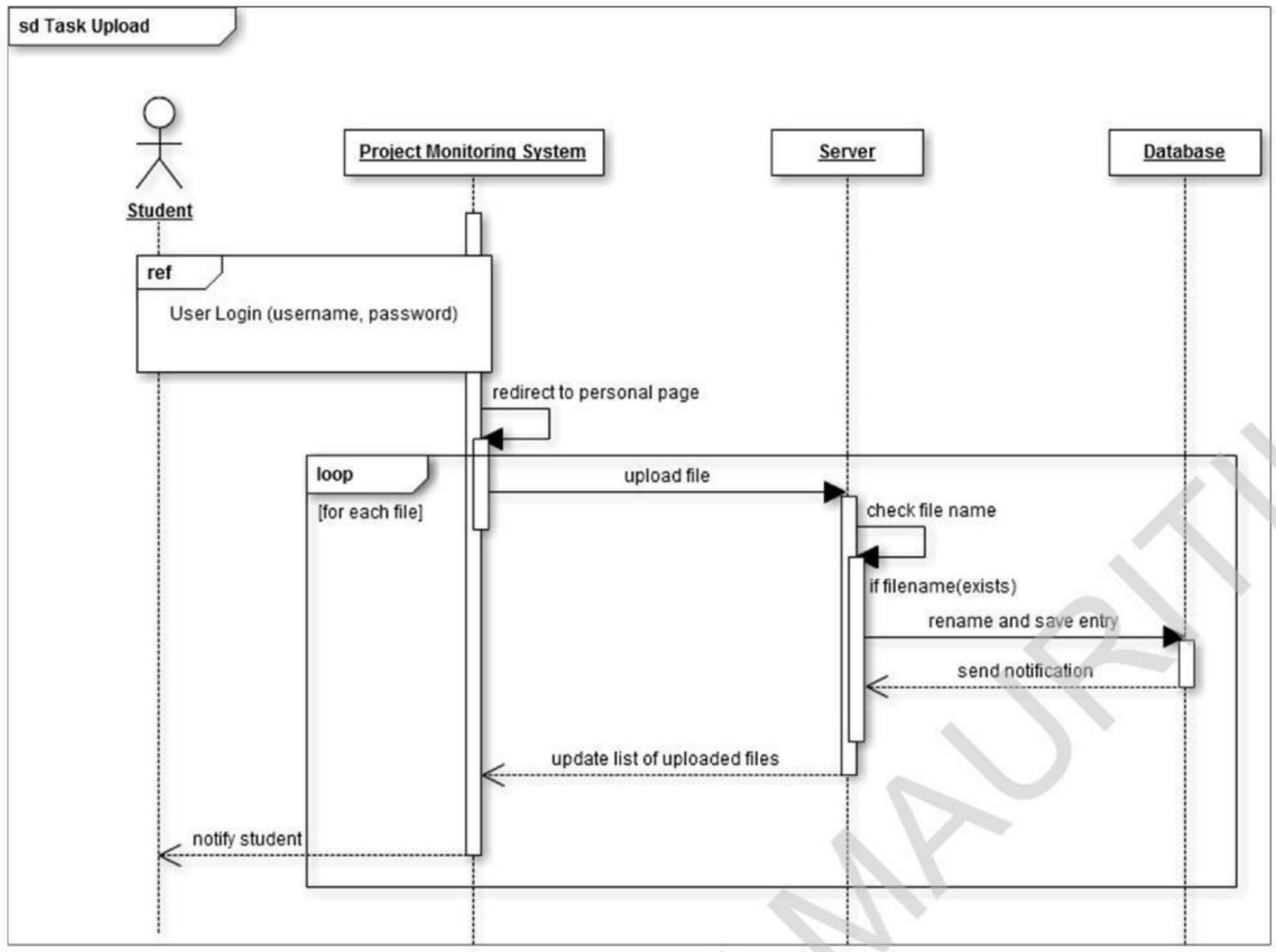

Figure 13: Sequence Diagram – Task Upload

The student has to login to be able to upload a file. If the filename already exists, it is renamed then stored in the folder "uploads" and its details stored in the database.

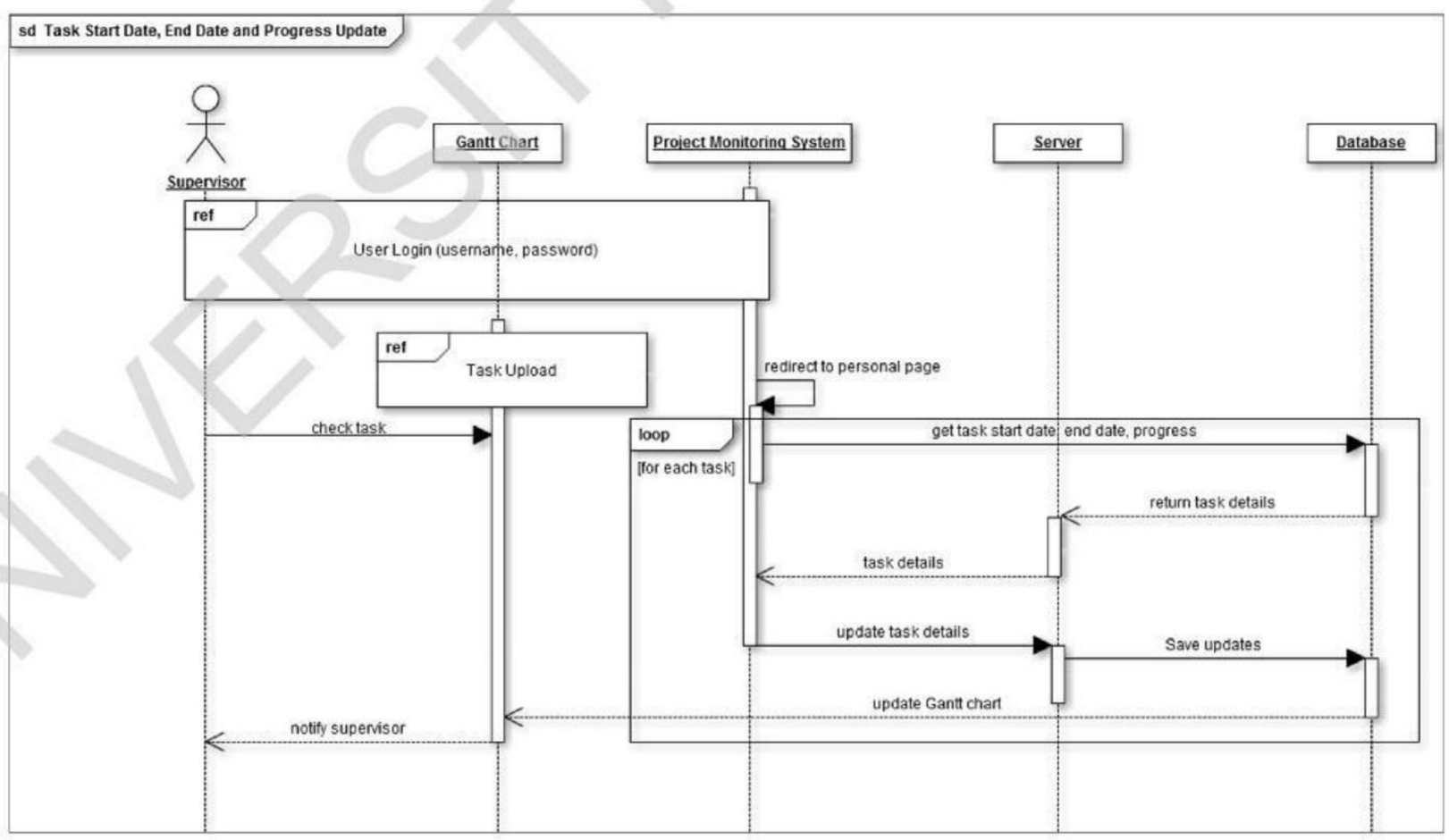

Figure 14: Sequence Diagram - Task Start Date, End Date and Progress Update

The supervisor will be able to update the start date, end date and percentage completion of a task.

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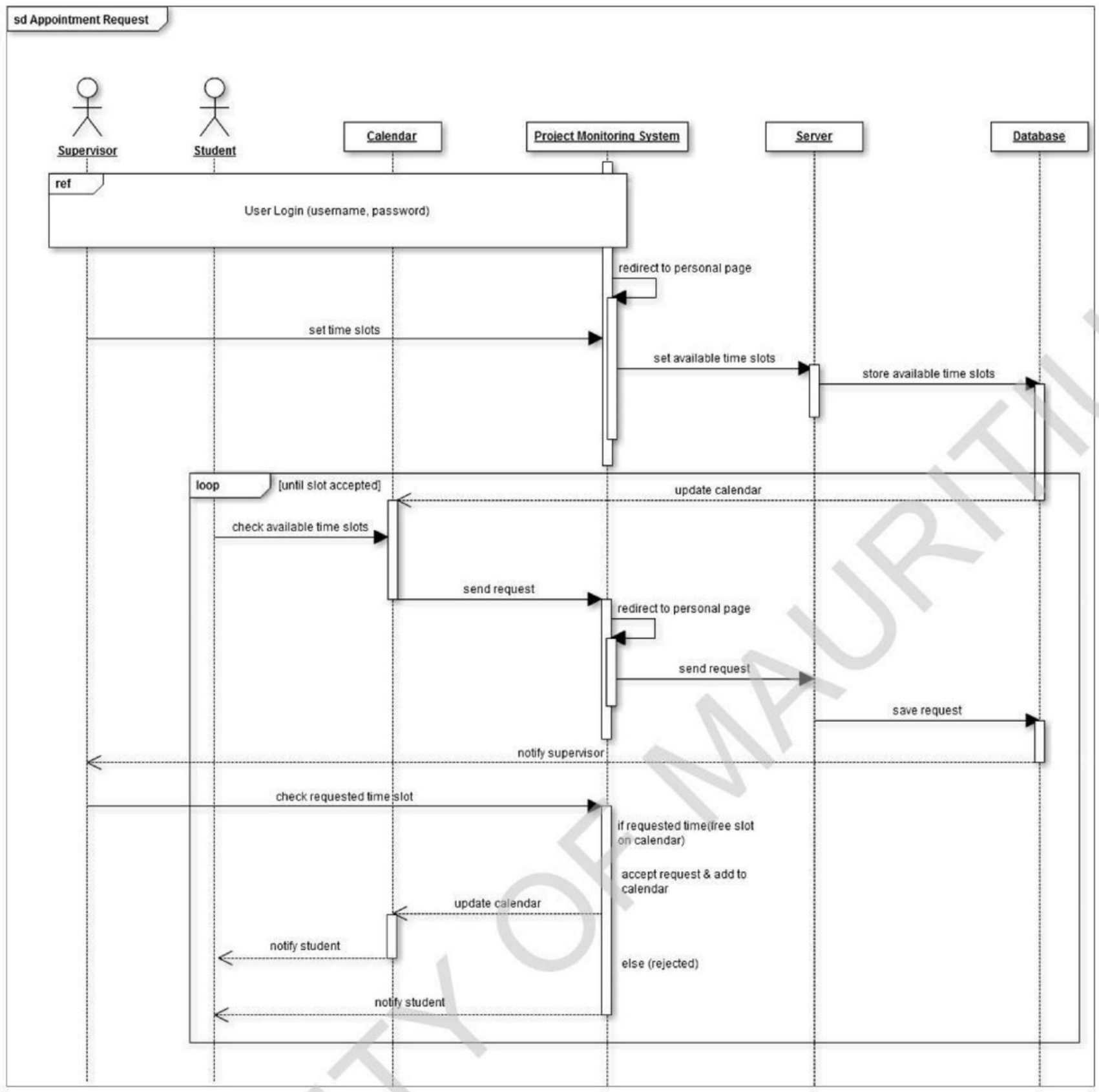

Figure 15: Sequence Diagram – Appointment Request

The supervisor will be able to make available his timetable which after consultation by project students, the latter will be able to send appointment requests for free time slots.

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2. State Transition Diagram

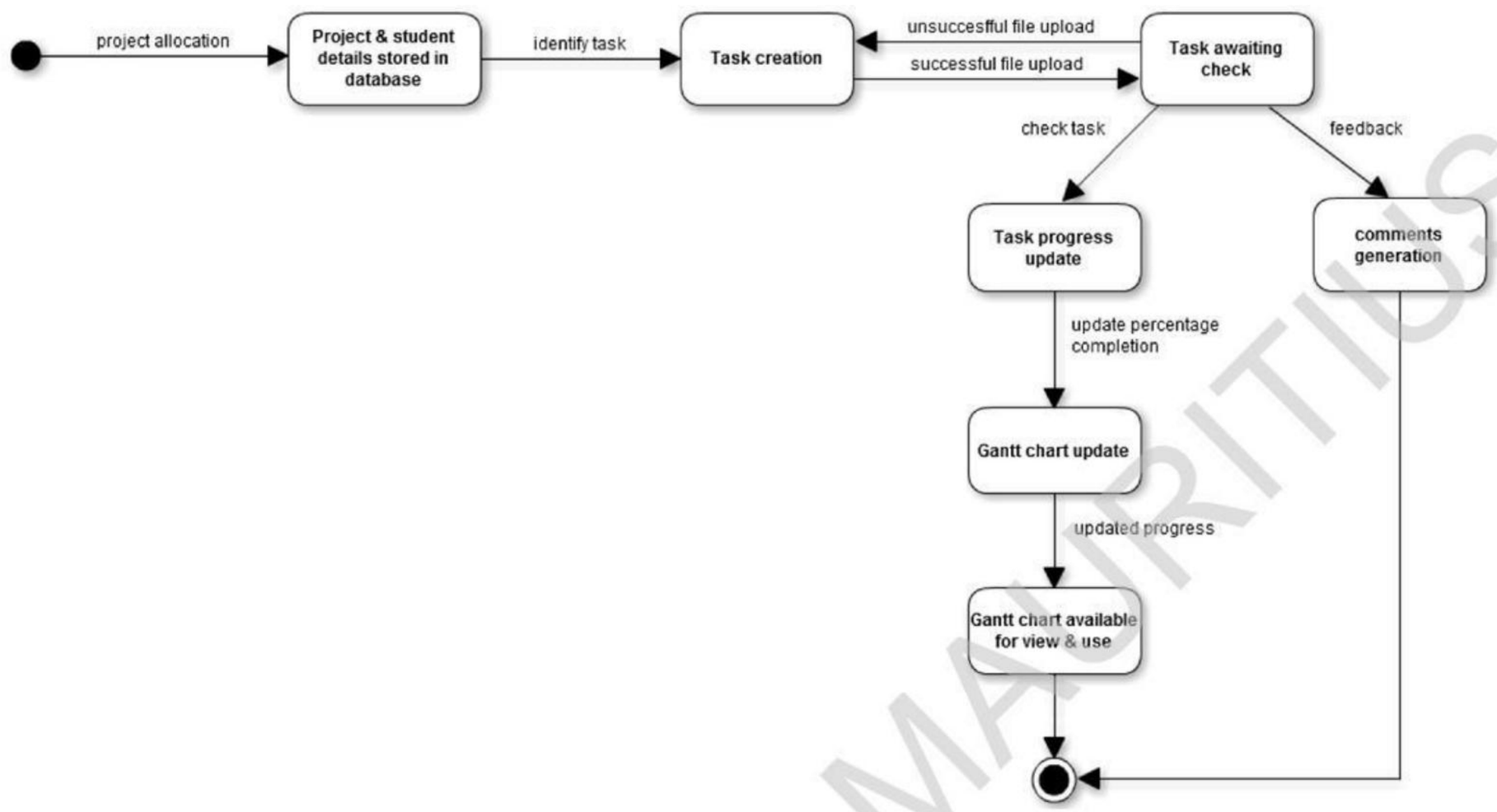

Figure 16: State Transition Diagram – Project Supervision and Progress Monitoring Process

Project supervision necessitates a project allocation process to enable effective progress monitoring. This is done when tasks have been created, files have been uploaded for specific tasks, and supervisors have provided feedback for each of the deliverables. Additionally, the supervisor is able to update the progress of each task accordingly which is reflected on the timeline for each project made available for viewing by concerned project students.

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4.3.1 Entity Relationship Diagram

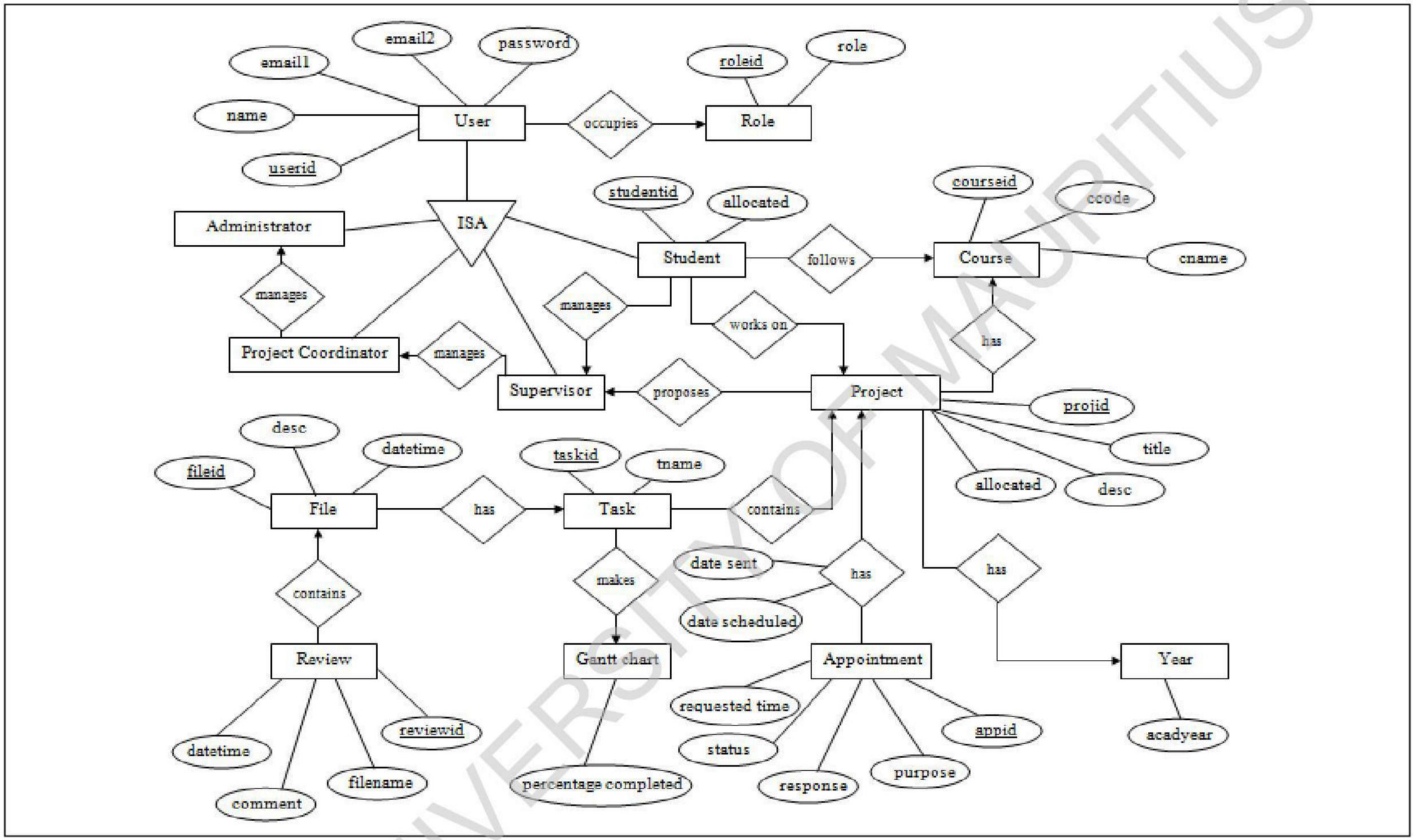

Figure 17: Entity Relationship Diagram

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4.4 Database Design

4.4.1 Table Design

logindata stores users' login details					
Field	*Data Type*	*Length*	*Constraints*	*Index*	*Description*
id	int	11	Not Null, Autoincrement	PK	Uniquely identifies a user
pId	int	11	Not Null, Unique	FK	Uniquely identifies a project, link to project
email1	varchar	100	Not Null		Email address of first user (e.g 1st Student)
email2	varchar	100	Not Null		Email address of second user (e.g 2nd Student)
passsword	varchar	100	Not Null		User's password
role	int	11	Not Null	FK	Role occupied by user, link to role
cid	int	11	Not Null	FK	Uniquely identifies a course, link to course

Table 3: Table Design –logindata

role stores the different roles to be occupied by users					
Field	*Data Type*	*Length*	*Constraints*	*Index*	*Description*
id	int	11	Not Null, Autoincrement	PK	Uniquely identifies a role
role	varchar	30	Not Null		Description of role

Table 4: Table Design – role

course stores the different courses on offer					
Field	*Data Type*	*Length*	*Constraints*	*Index*	*Description*
cid	int	11	Not Null, Autoincrement	PK	Uniquely identifies a course
ccode	varchar	10	Not Null		Course code
cname	varchar	100	Not Null		Course title

Table 5: Table Design – course

currentyear stores the current academic year for project allocation					
Field	*Data Type*	*Length*	*Constraints*	*Index*	*Description*
acadyear	varchar	9	Not Null		Current academic year

Table 6: Table Design - currentyear

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appointmentrequest stores project meeting details					
Field	*Data Type*	*Length*	*Constraints*	*Index*	*Description*
id	int	11	Not Null, Autoincrement	PK	Uniquely identifies a meeting request
pId	int	11	Not Null, Unique	FK	Uniquely identifies a project, link to project
uname	varchar	50	Not Null		Username of requestor
ptitle	varchar	200	Not Null		Title of project for which meeting is requested
apdate	varchar	20	Not Null		Appointment date
aptime	varchar	5	Not Null		Appointment time
apduration	int	11	Not Null		Duration of the meeting
apdesc	text		Not Null		Purpose of the meeting
status	varchar	10	Not Null		Identifies whether the meeting has been accepted or declined
response	text		Not Null		The supervisor's response

Table 9: Table Design - appointmentrequest

tasklist stores the tasks to be done in a project					
Field	*Data Type*	*Length*	*Constraints*	*Index*	*Description*
taskid	int	11	Not Null, Autoincrement	PK	Uniquely identifies a task
taskname	varchar	100	Not Null		Name of the task

Table 10: Table Design - tasklist

reviews stores comments from supervisor for works uploaded					
Field	*Data Type*	*Length*	*Constraints*	*Index*	*Description*
id	int	11	Not Null, Autoincrement	PK	Uniquely identifies a review
fileid	int	11	Not Null, Unique	FK	Uniquely identifies a file uploaded, link to file
supemail	varchar	50	Not Null		Email address of supervisor
supcomment	text		Not Null		Comment from the supervisor
datetime	timestamp		Not Null		Date and time the comment is made

Table 11: Table Design - reviews

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gantt stores progress of each task according to schedules					
Field	*Data Type*	*Length*	*Constraints*	*Index*	*Description*
pId	int	11	Not Null, Autoincrement	PK	Uniquely identifies a project
taskid	int	10	Not Null, Unique		Uniquely identifies a task
startdate	date		Not Null		Start date of task
enddate	date		Not Null		End date of task
percentagecompleted	double		Not Null		Percentage completed of the task

Table 12: Table Design - gantt

fileuploads stores details of the files uploaded under a given task					
Field	*Data Type*	*Length*	*Constraints*	*Index*	*Description*
id	int	11	Not Null, Autoincrement	PK	Uniquely identifies a review
teamid	int	11	Not Null, Unique		Uniquely identifies a team
filename	varchar	50	Not Null		Name of uploaded file
description	text		Not Null		Description of what the file is about
taskid	int	11	Not Null	FK	Uniquely identifies a task, link to task
datetime	timestamp		Not Null		Date and time the file is uploaded

Table 13: Table Design - fileuploads

chat stores the exchange of messages between project student and supervisor					
Field	*Data Type*	*Length*	*Constraints*	*Index*	*Description*
chatid	int	11	Not Null, Autoincrement	PK	Uniquely identifies chat
pId	int	11	Not Null, Unique	FK	Uniquely identifies a project, link to project
chattext	text		Not Null		Chat text
sname	varchar	30	Not Null		Identifies student
supervisor	tinyint	1	Not Null		Identifies supervisor
datetime	timestamp		Not Null		Date and time a message is sent/received

Table 14: Table Design - chat

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studentlist stores project students details					
Field	*Data Type*	*Length*	*Constraints*	*Index*	*Description*
id	int	11	Not Null, Autoincrement	PK	Uniquely identifies a student
studentid	varchar	50	Not Null, Unique		Student ID of student provided by university
fname	varchar	50	Not Null		First name of student
sname	varchar	30	Not Null		Last name of student
email	varchar	50	Not Null		Email address of student
cid	int	11	Not Null	FK	Uniquely identifies a course, link to course
allocated	tinyint	1	Not Null		Identifies whether project is allocated or not

Table 7: Table Design - studentlist

projectallocation stores project details					
Field	*Data Type*	*Length*	*Constraints*	*Index*	*Description*
pId	int	11	Not Null, Autoincrement	PK	Uniquely identifies a project
supname	varchar	100	Not Null, Unique		Name of supervisor
supemail	varchar	100	Not Null		Email address of supervisor
cid	int	10	Not Null	FK	Uniquely identifies a course, link to course
parea	varchar	200	Not Null		Project area
ptitle	varchar	200	Not Null		Project title
pdescription	text		Not Null		Project description
pproblemdefinition	text		Not Null		Problem definition of project
paimobjective	text		Not Null		Aim and objectives of project
presearchoutput	text		Not Null		Research output of project
psofthard	text		Not Null		Hardware and software to be used for the project
allocated	tinyint	1	Not Null		Identifies whether project is allocated or not
acadyear	varchar	9	Not Null		Uniquely identifies a course, link to course

Table 8: Table Design - projectallocation

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4.5 Interface Design

Interfaces have been designed after a few suggestions from supervisors and project students. It comprises a straightforward and intuitive layout bearing resemblance to the system used by lecturers to input student grades with the intent that the system would be easily accepted and adopted due to this familiarity.

Figure 19 shows the home page for the Project Supervision System and allows users to login to their personal area. Based on the credentials, the users, mainly the administrator, project coordinators, supervisors and students are redirected to a restricted page where they are able to see only private information.

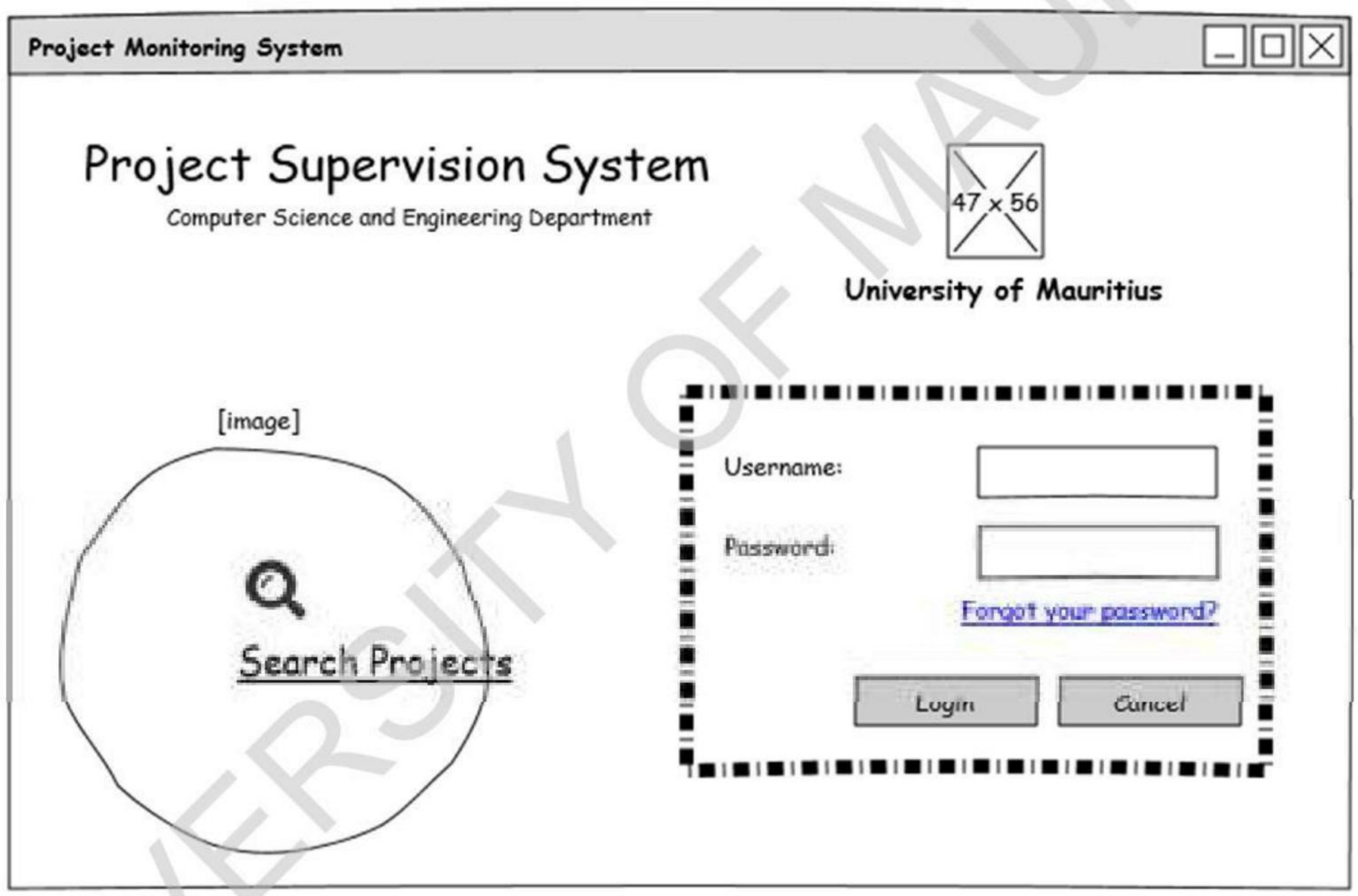

Figure 19: Project Supervision System Home Page

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Clicking on Search Projects allows the user to search for projects using a web service. The terms to be searched for can be found in the project title, in the description or project area.

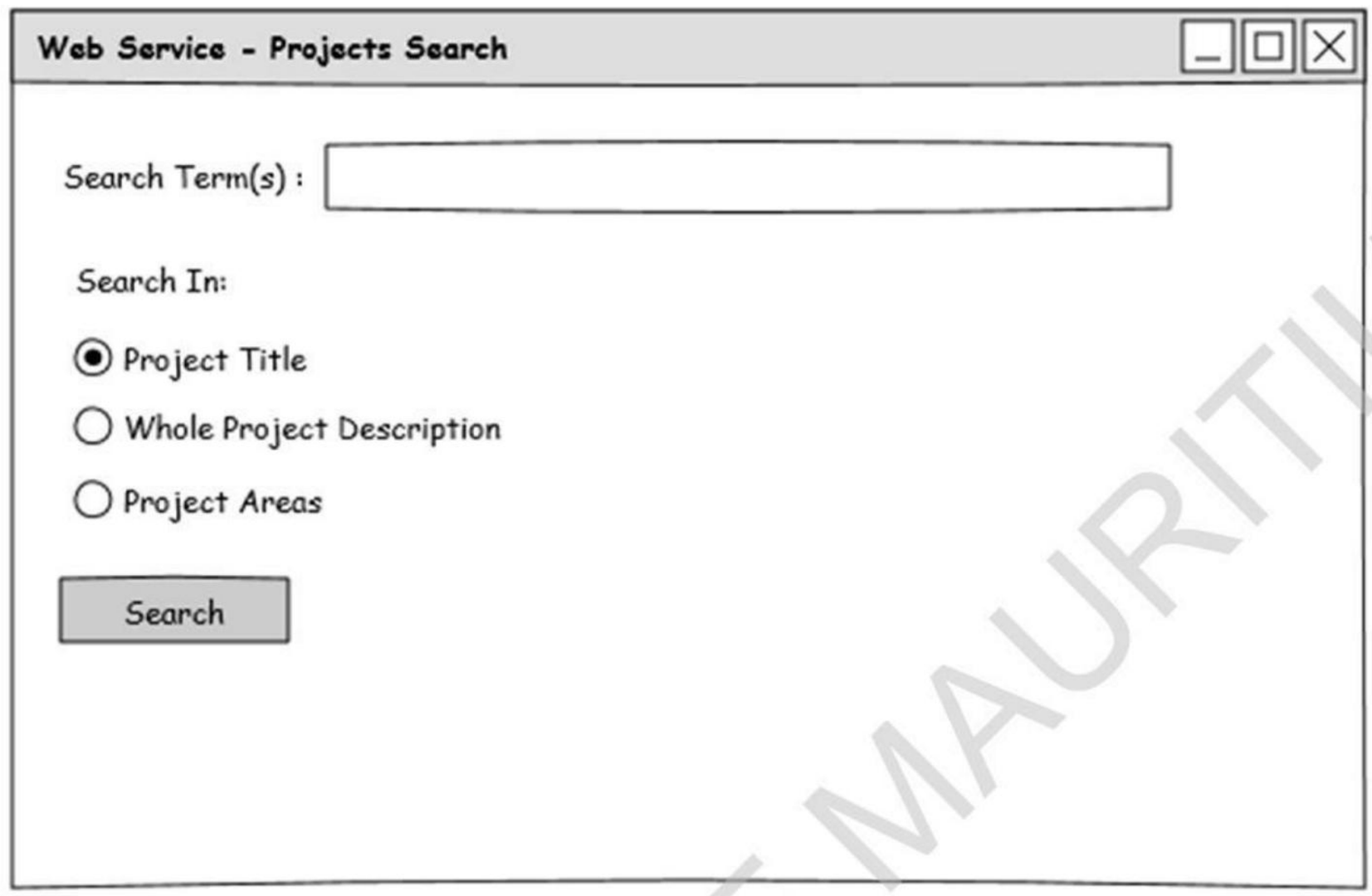

Figure 20: Web Service

Using the search term "cars" and selecting project title, for example would give all the results that have "cars" in the project title.

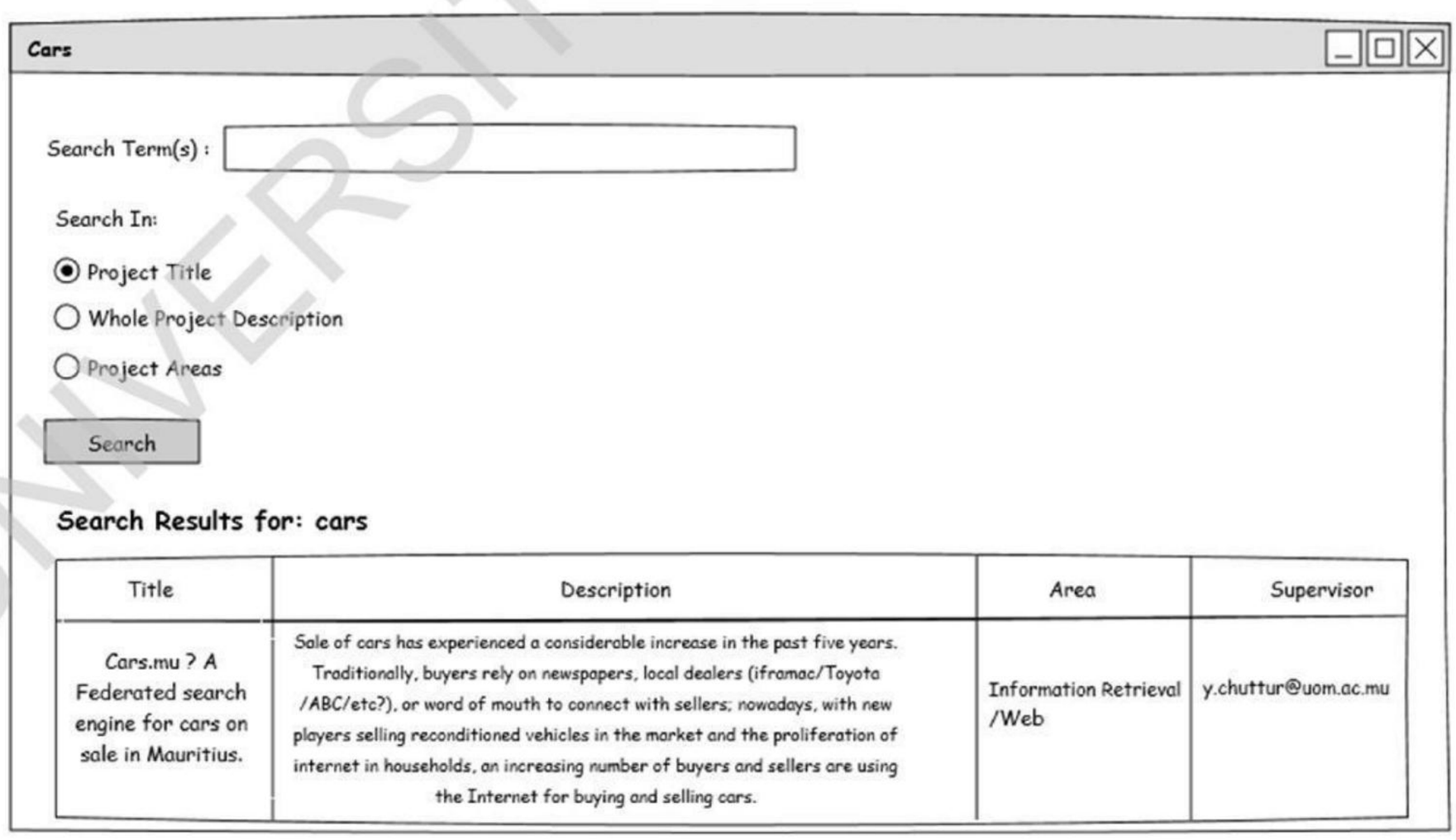

Figure 21: Search results displayed

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After the administrator has logged in, he is provided with a page as shown below, with the following menus.

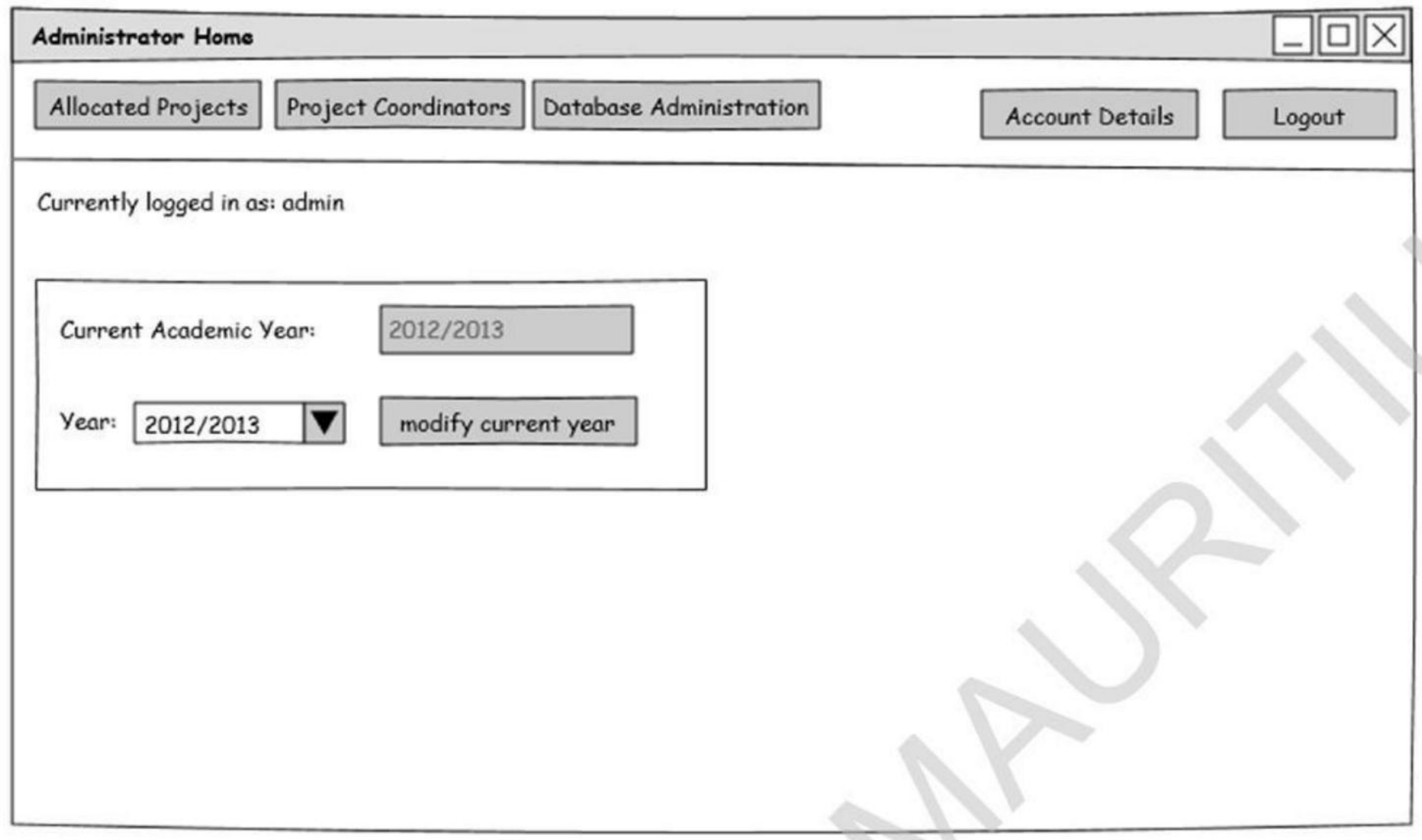

Figure 22: Administrator's Home Page

Clicking on Allocated Project leads to a list of different courses being offered, and the administrator is able to choose for which course to view the projects that have been allocated.

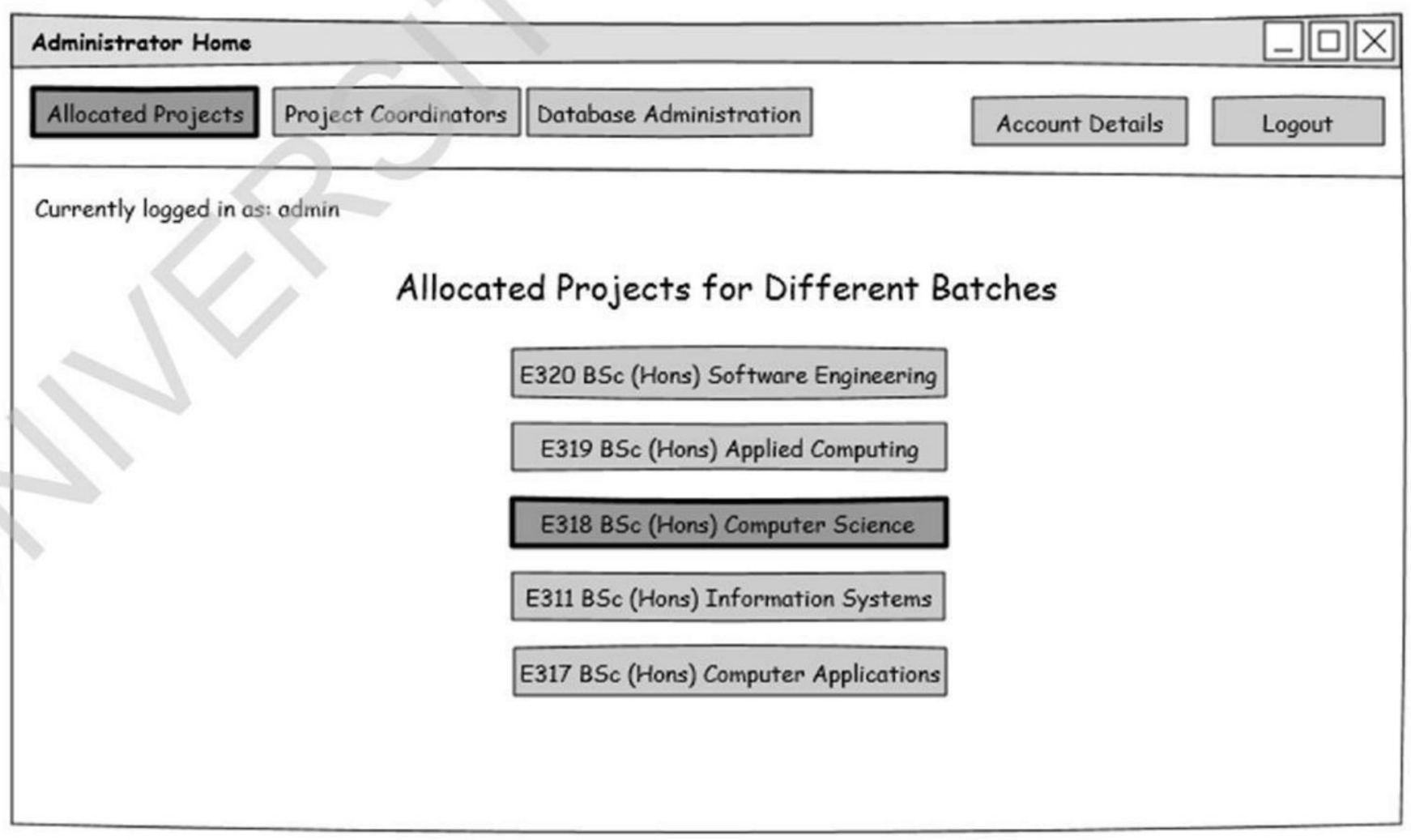

Figure 23: View Allocated Projects for the Different Batches

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An example is shown in Figure 24.

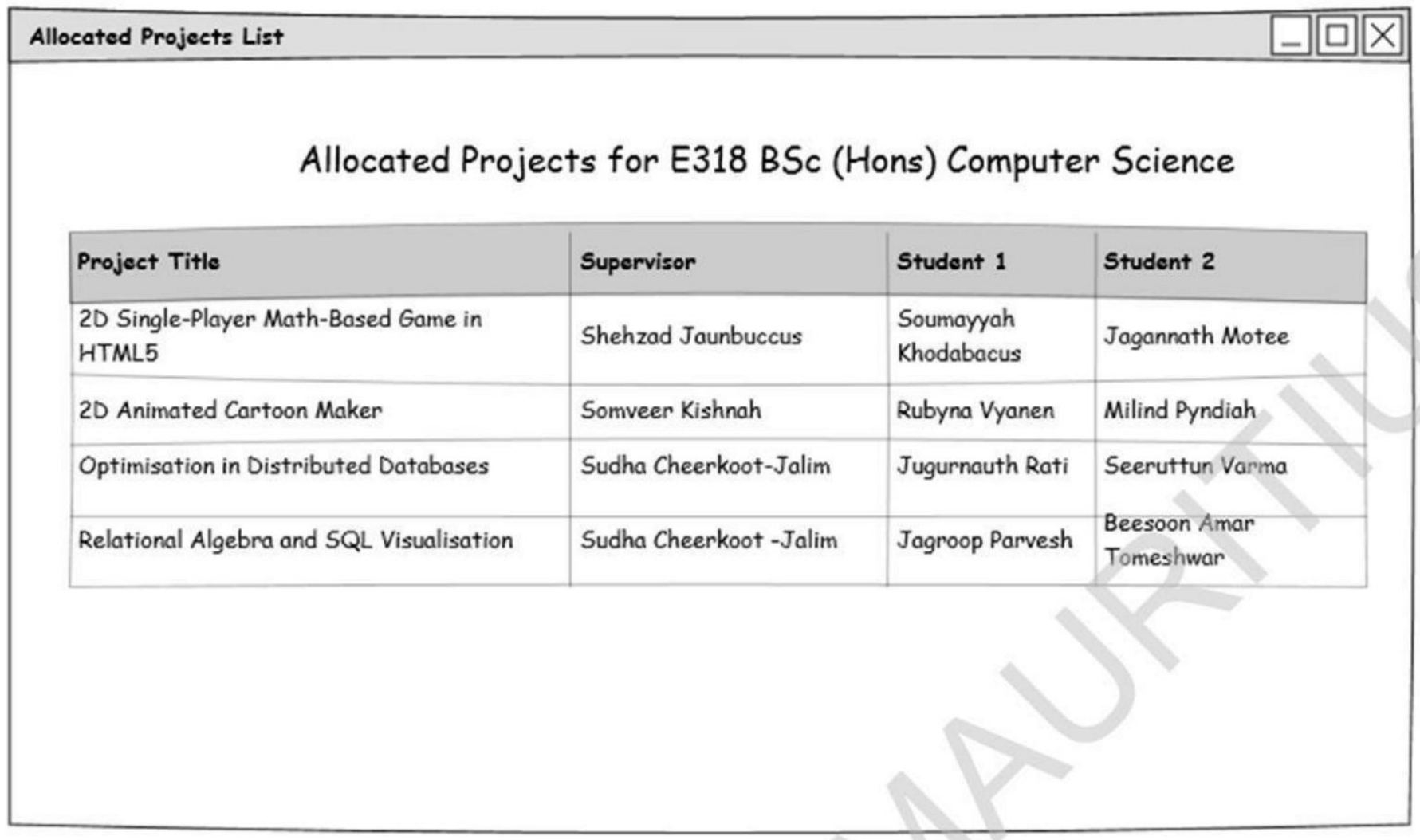

Figure 24: Example Projects Allocated for a particular course

Clicking on Project Coordinators allows the administrator to manage accounts for project coordinators.

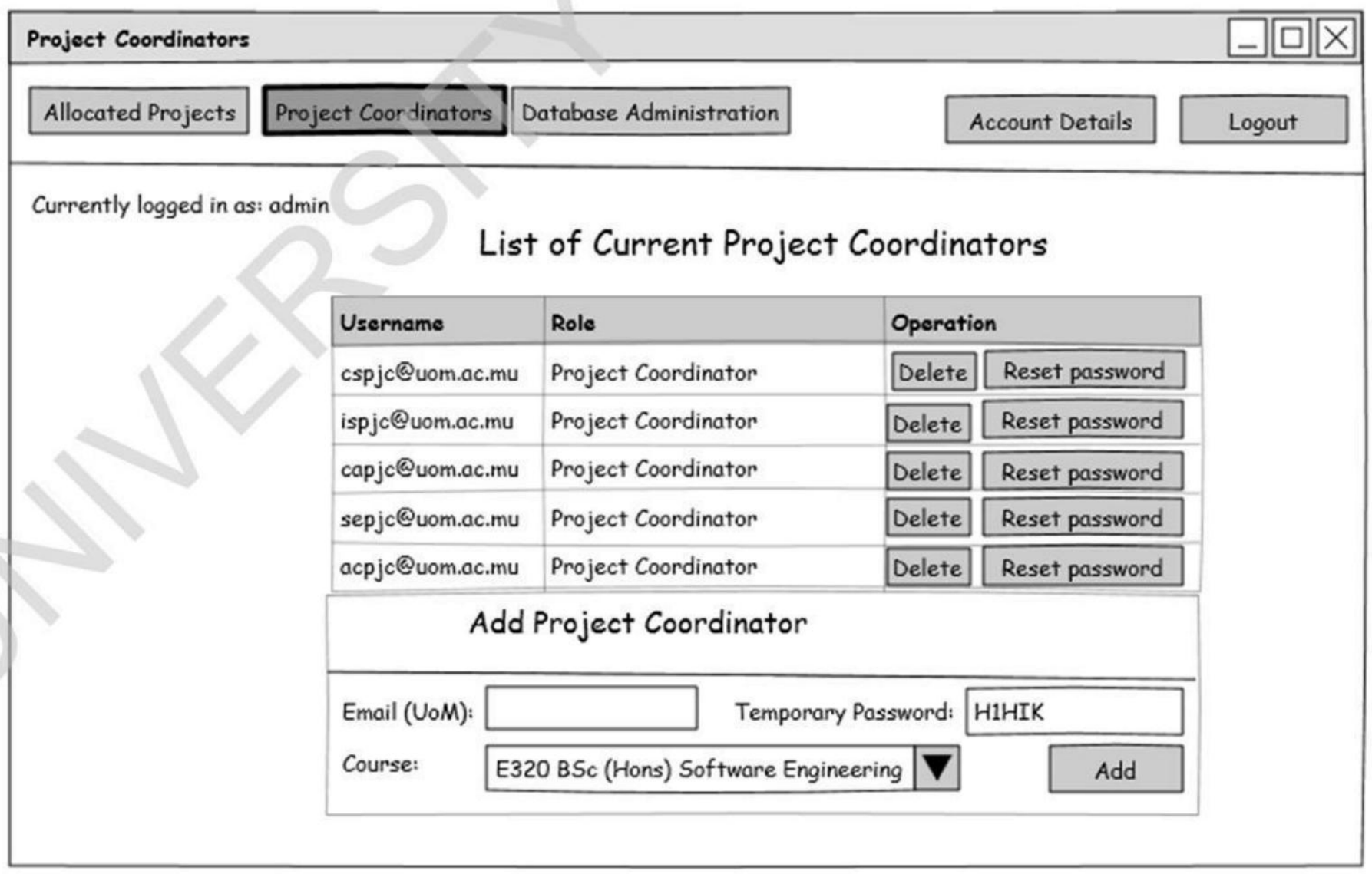

Figure 25: Manage Project Coordinators Accounts

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Selecting Database Administration provides the administrator with functionalities to manage the database and all tables.

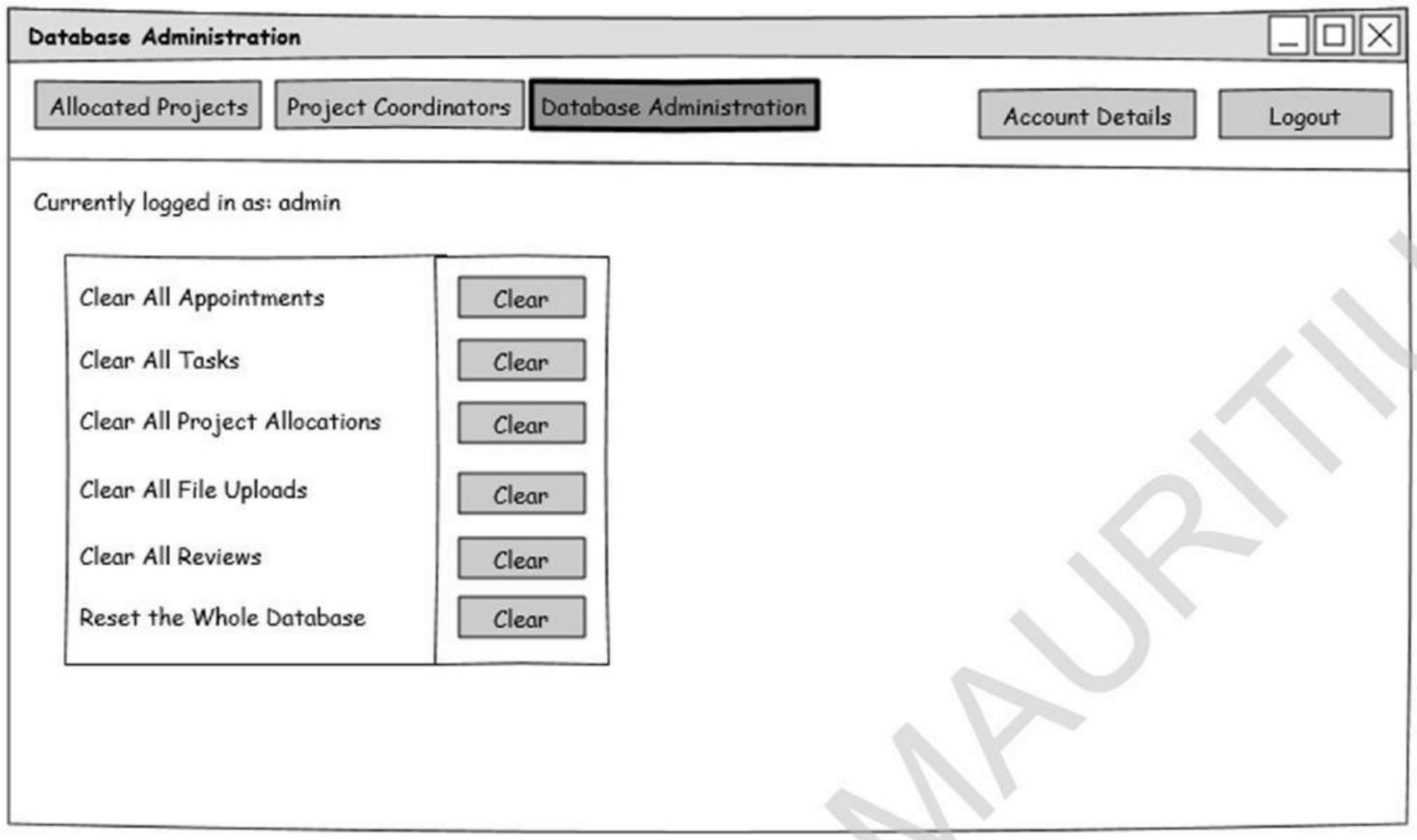

Figure 26: Database Administration

Clicking on Account Details allows the administrator to set his personal information and to change his password. After logging out, he is redirected to the home page.

Figure 27: Account Details for Administrator

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When a project coordinator logs in to the project supervision system, he is presented with the following functionalities. Clicking on Project Allocation allows the project coordinator for a particular course to select a project, the first student and the second student and assign them the project.

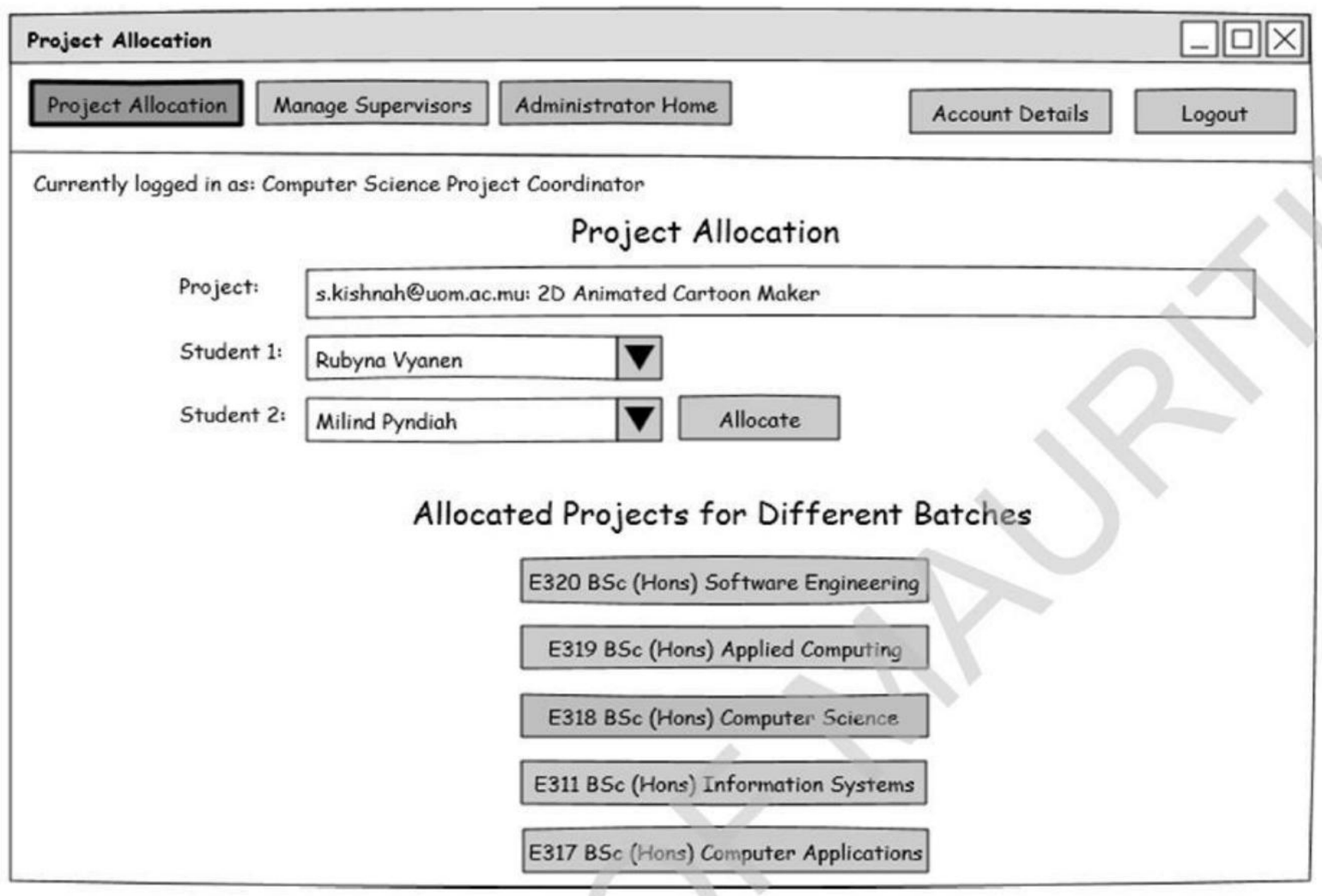

Figure 28: Project Allocation by Project Coordinator

Clicking on Manage Supervisors allows the project coordinator to create accounts, delete accounts and reset passwords for each supervisor.

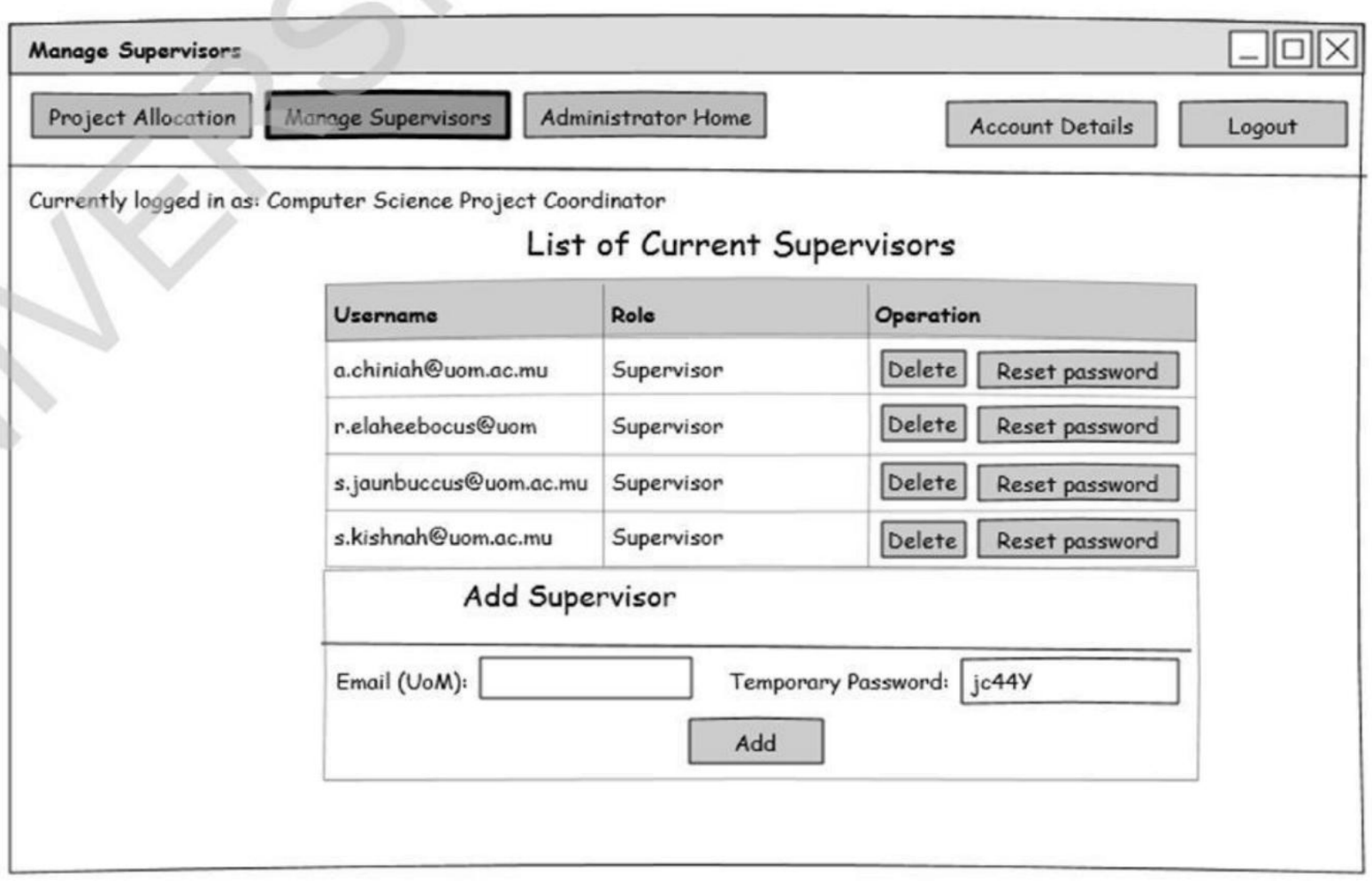

Figure 29: Manage Supervisors Accounts by Project Coordinator

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Clicking on Account Details allows the project coordinator to set his personal information and to change his password. After logging out, he is redirected to the home page.

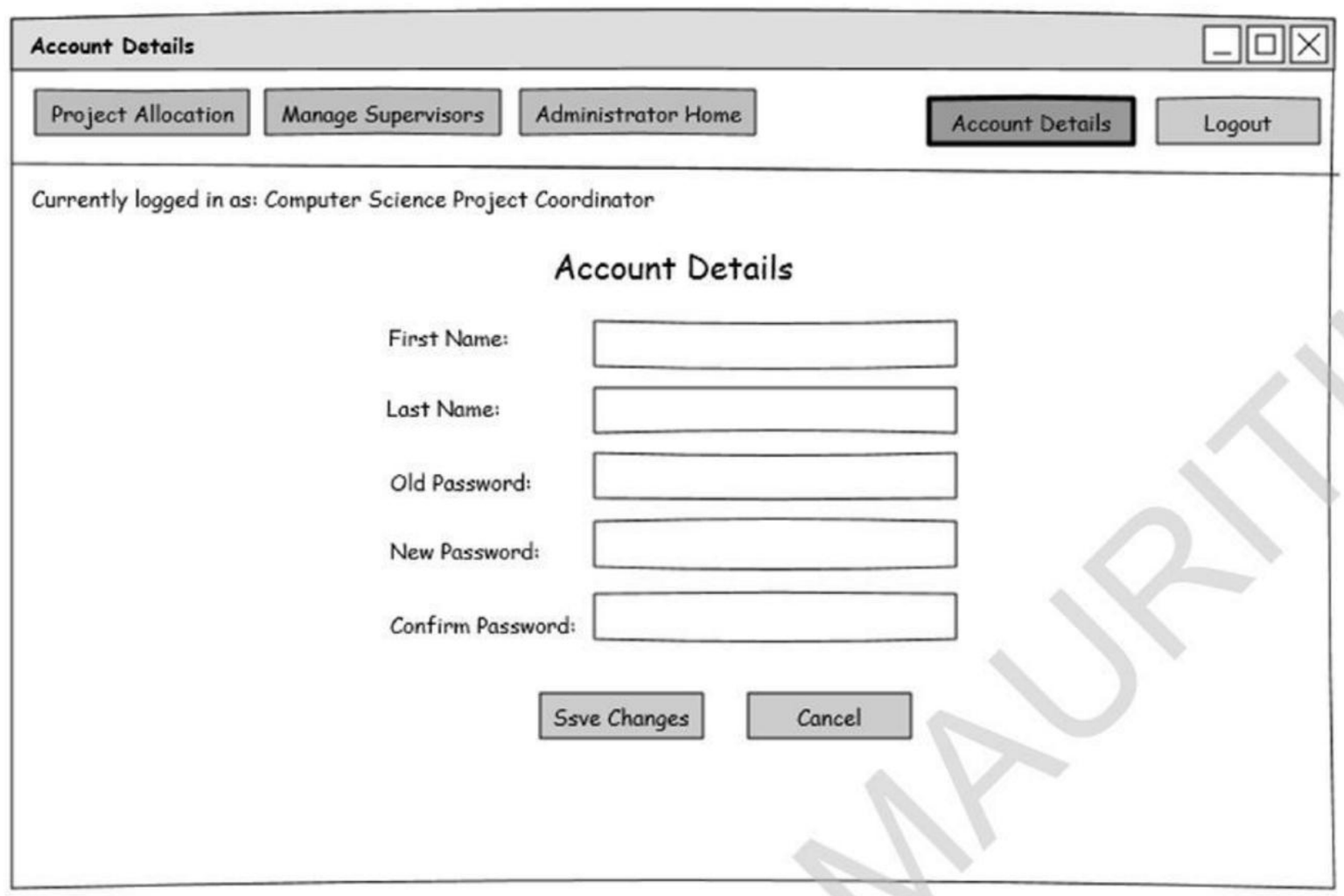

Figure 30: Account Details for Project Coordinator

When a supervisor logs in to the system, he is able to see all his projects and students for the different courses.

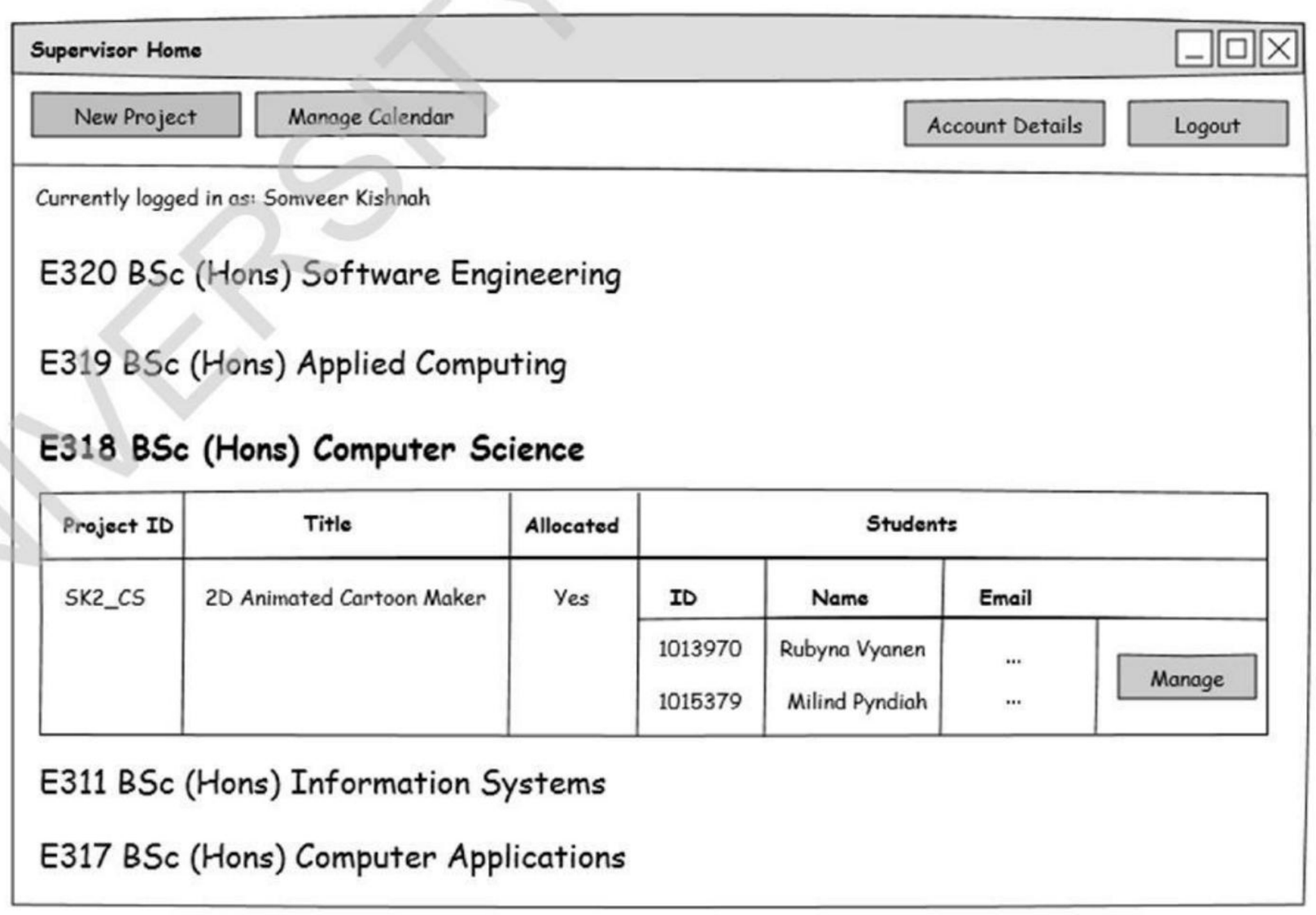

Figure 31: Supervisor's Home Page

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Clicking on New Project allows the supervisor to input new projects into the system, although no allocation is going to be made instantly.

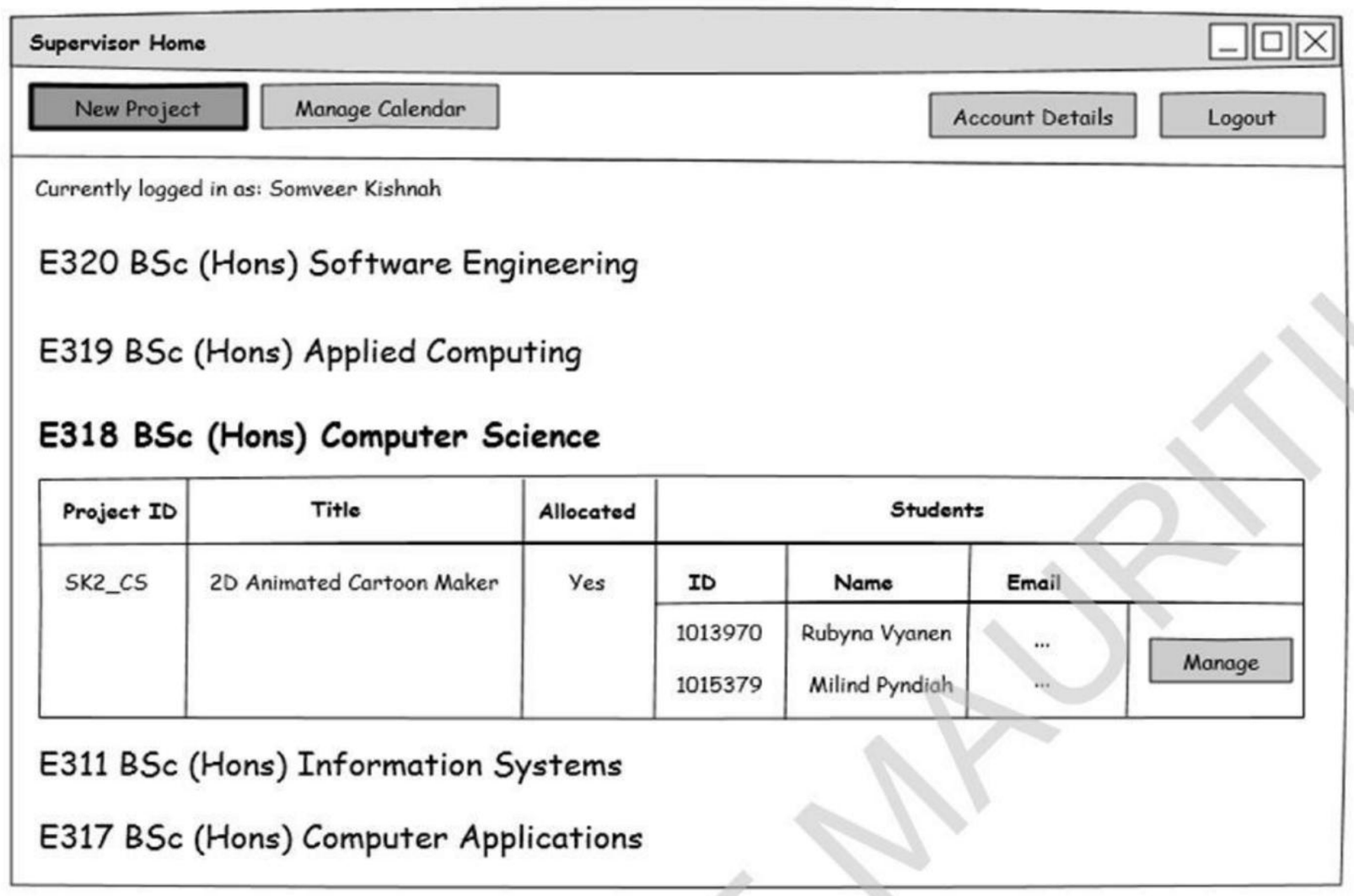

Figure 32: New Project Menu – Supervisor's Page

The supervisor chooses for which course the project is going to be proposed and adds it to the project supervision system through the interface shown below:

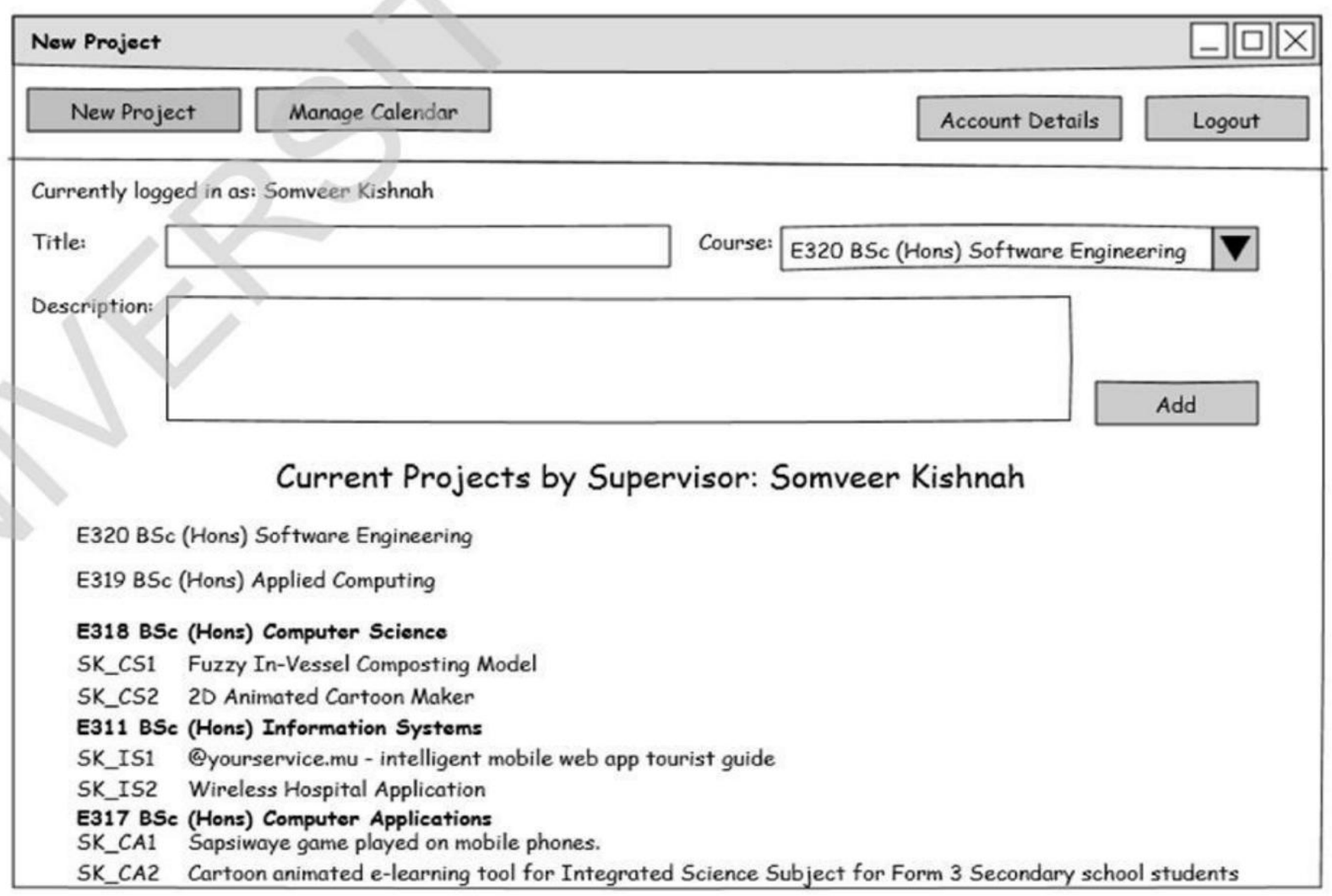

Figure 33: Interface for Supervisor to input new projects

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Clicking on Manage for a specific project allows the supervisor to monitor the progress of each project based on the tasks completed.

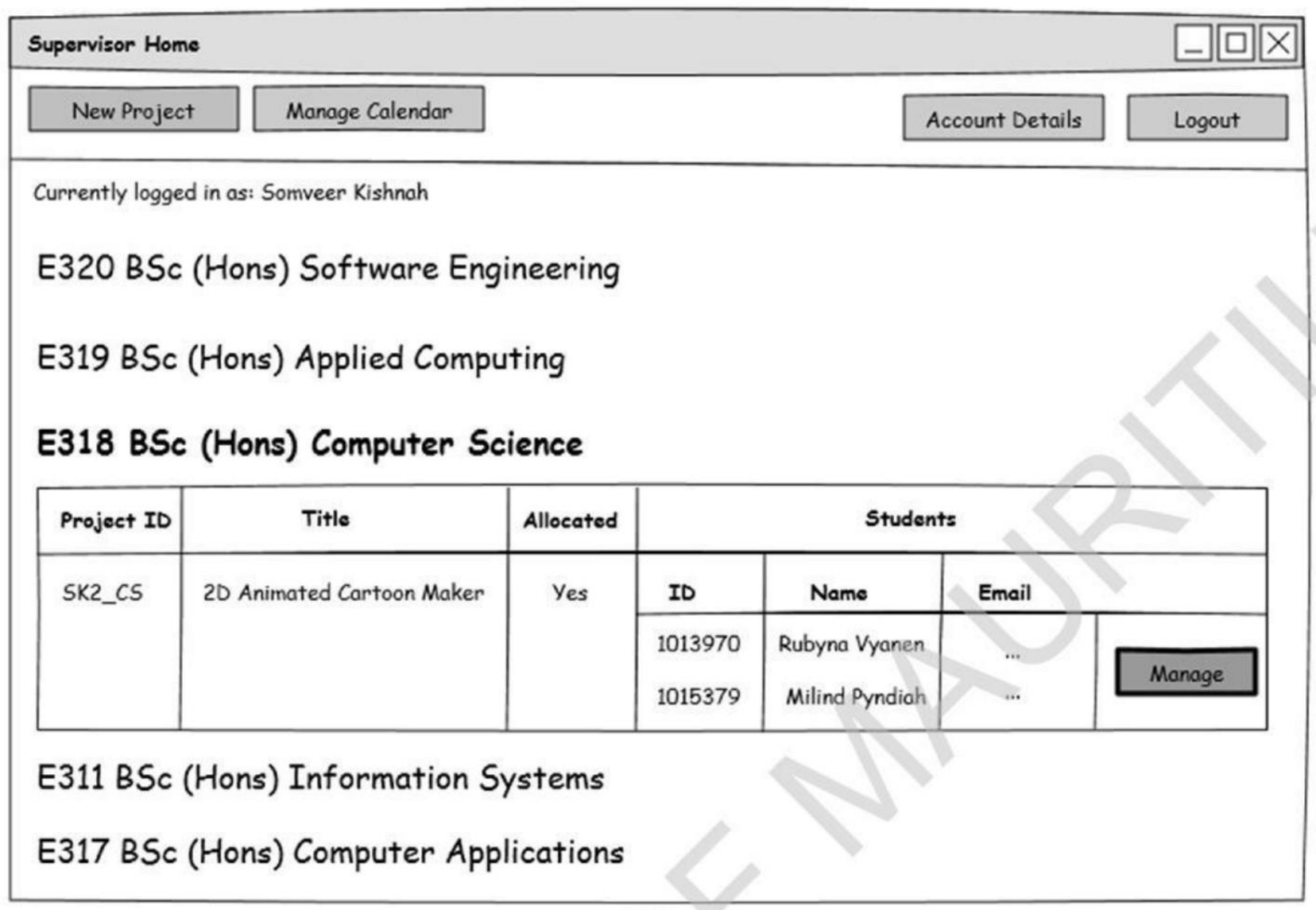

Figure 34: To allow the supervisor to manage a particular project

The following interface allows the supervisor to set the task, its start date and end date. The task is then added and reflected on the project timeline. Each task details can be updated accordingly when the supervisor deems necessary.

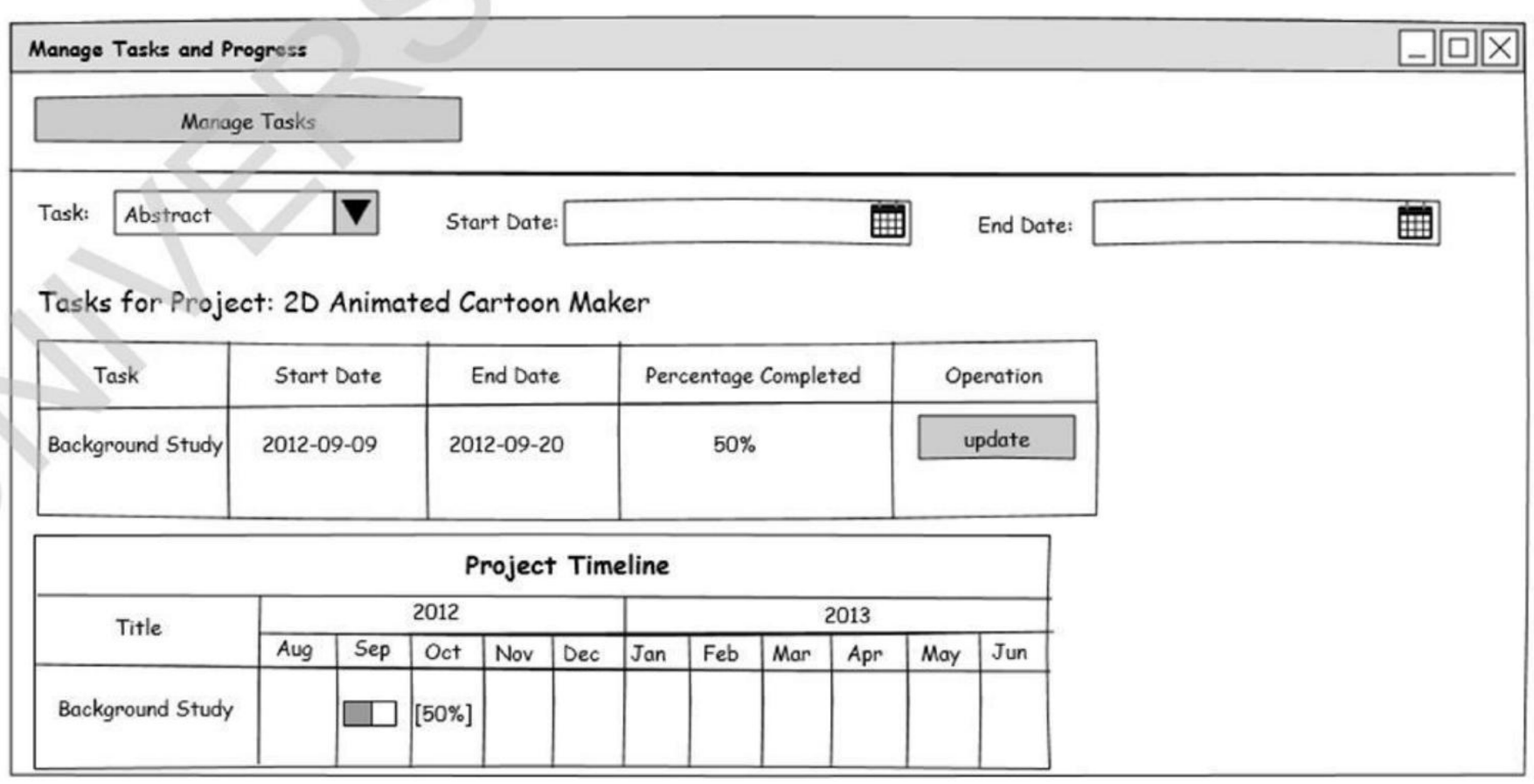

Figure 35: Interface to allow supervisor to set task details and update when required

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Clicking on Manage Calendar allows the supervisor to set the available time slots accept or decline meeting requests sent by his project students. Only requests that have been approved of by the supervisor are displayed on the calendar so that other students are aware when the supervisor is already taken up.

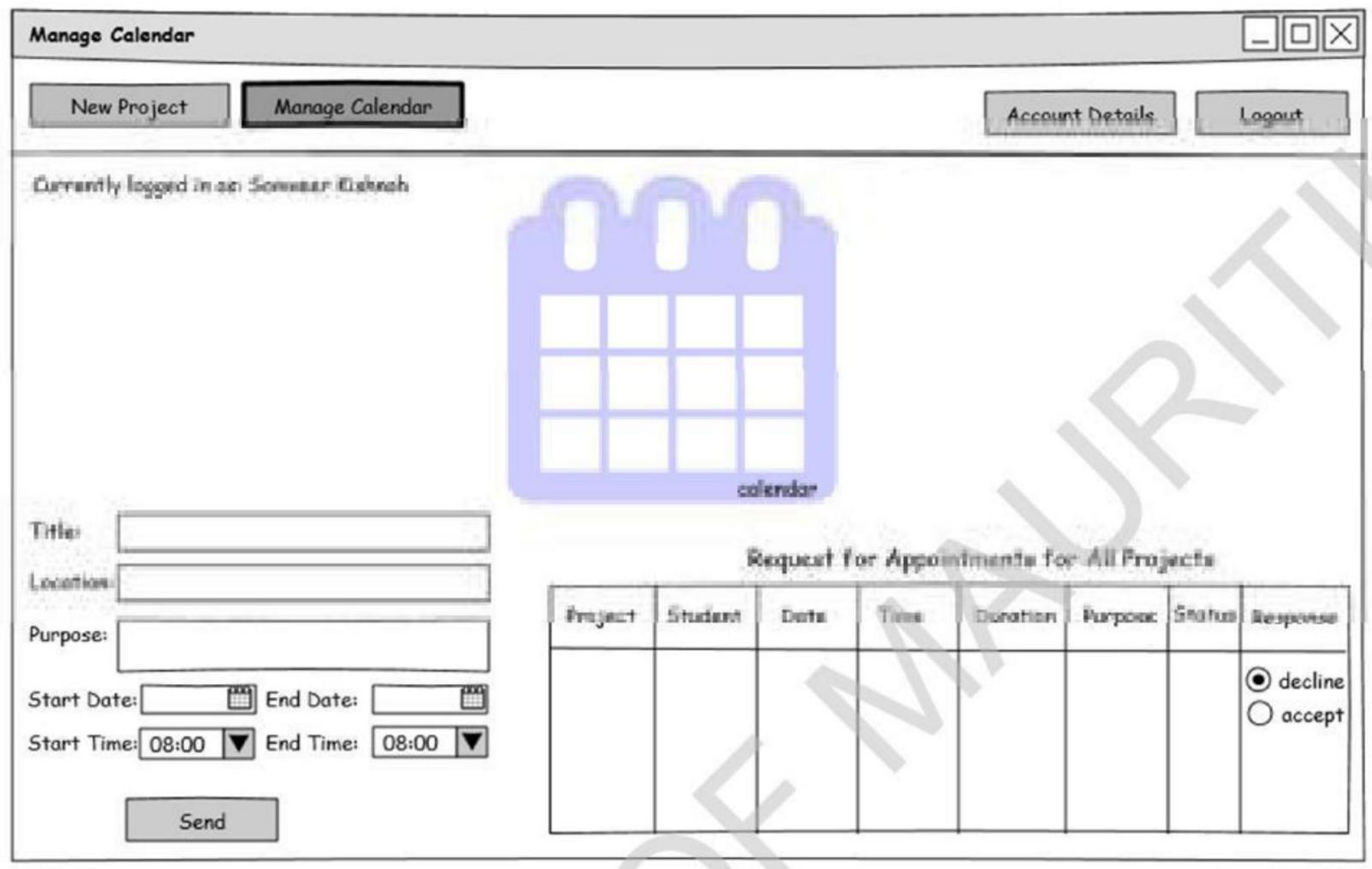

Figure 36: Manage Calendar menu for supervisor

Clicking on Account Details allows the supervisor to set his personal information and to change his password. After logging out, he is redirected to the home page.

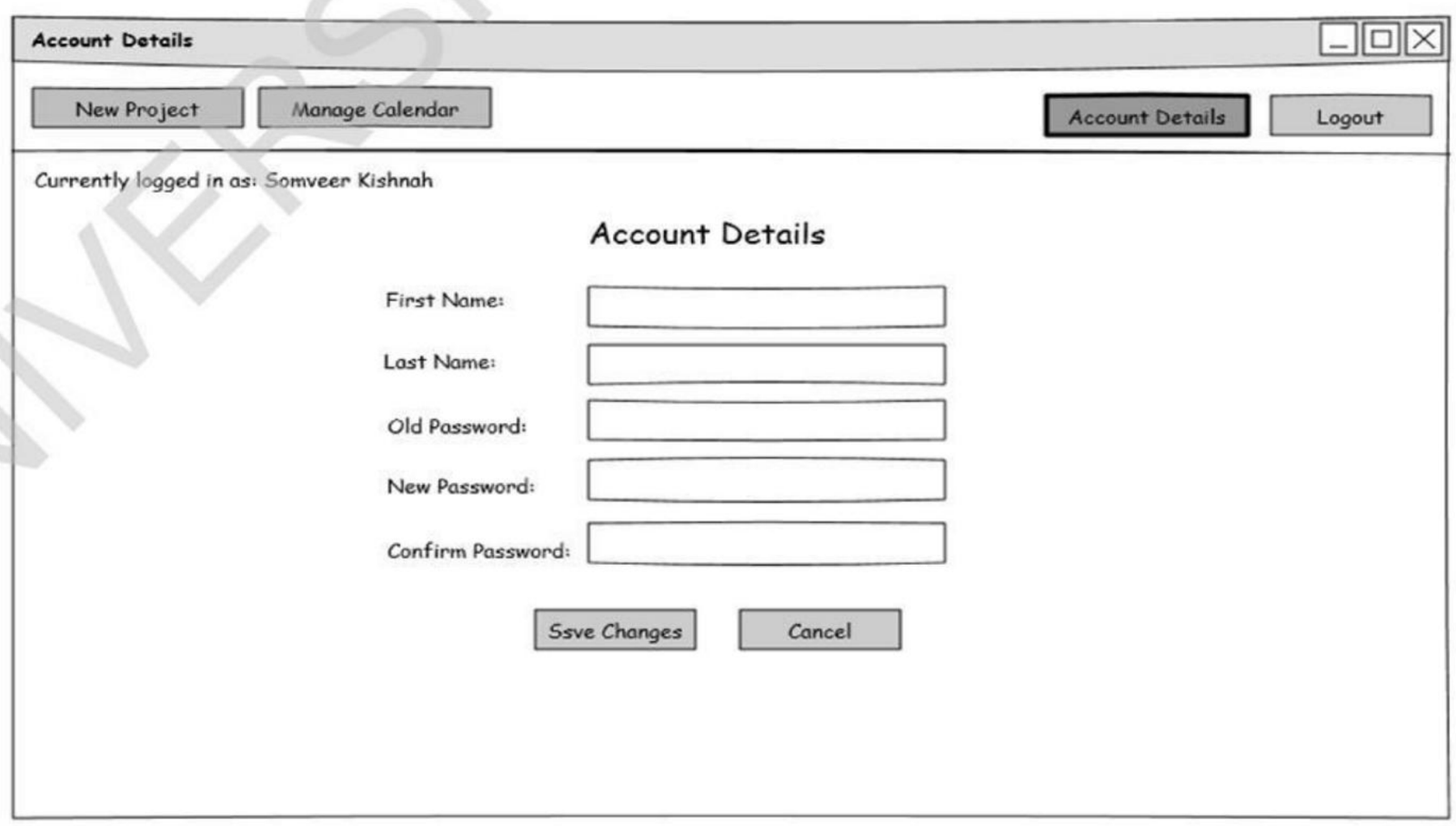

Figure 37: Account Details for supervisor

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When the student has logged in, he is presented with the following options. The interface shown in Figure 38 allows the student to send and receive messages to his supervisor.

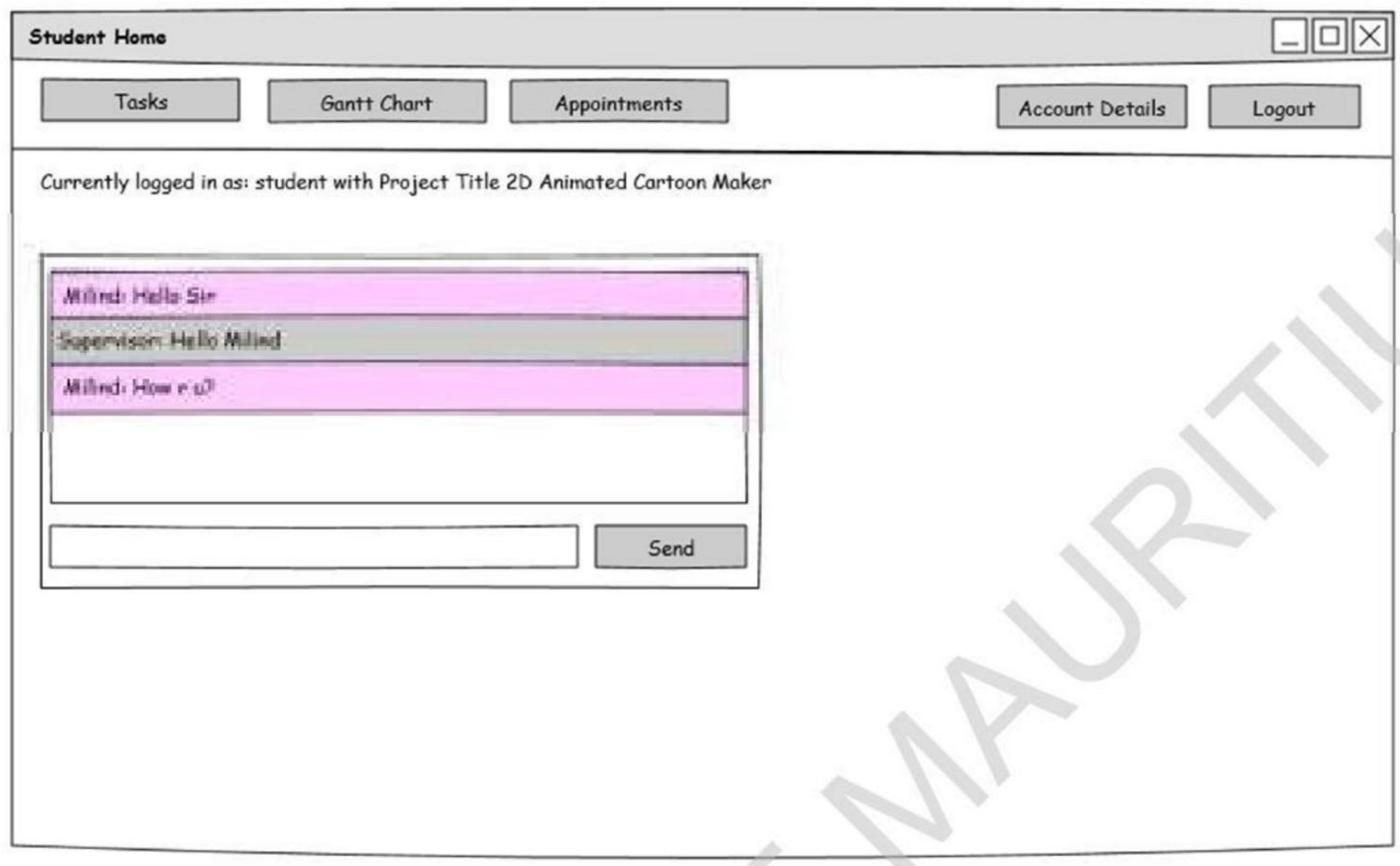

Figure 38: Interface to allow students to send/receive messages

Clicking on Tasks allows the student to upload files for the tasks that the supervisor has already set.

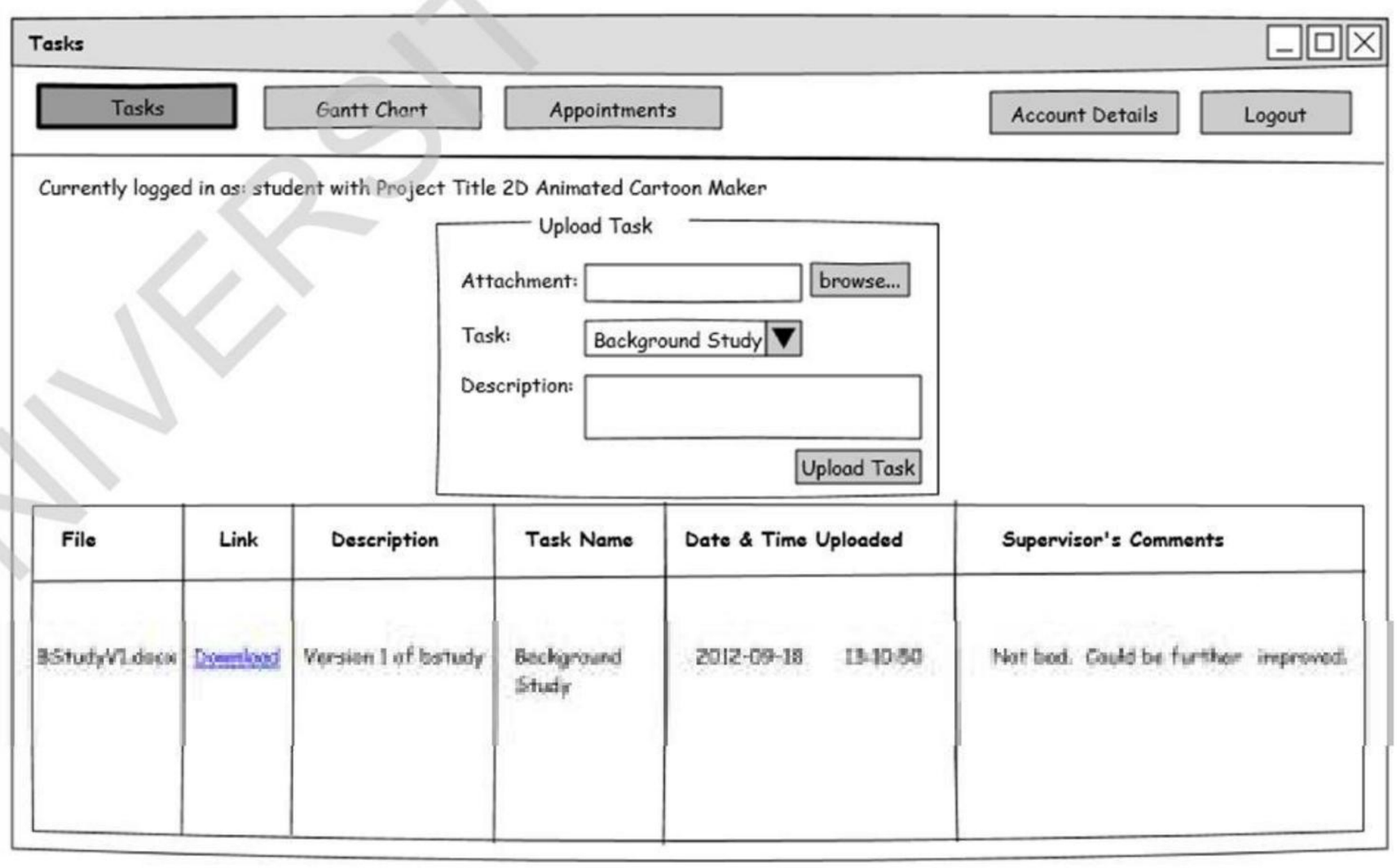

Figure 39: Interface to allow student to upload files which is then listed underneath

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Clicking on Gantt Chart allows the student to see the project's progress according to the updated details set by the supervisor.

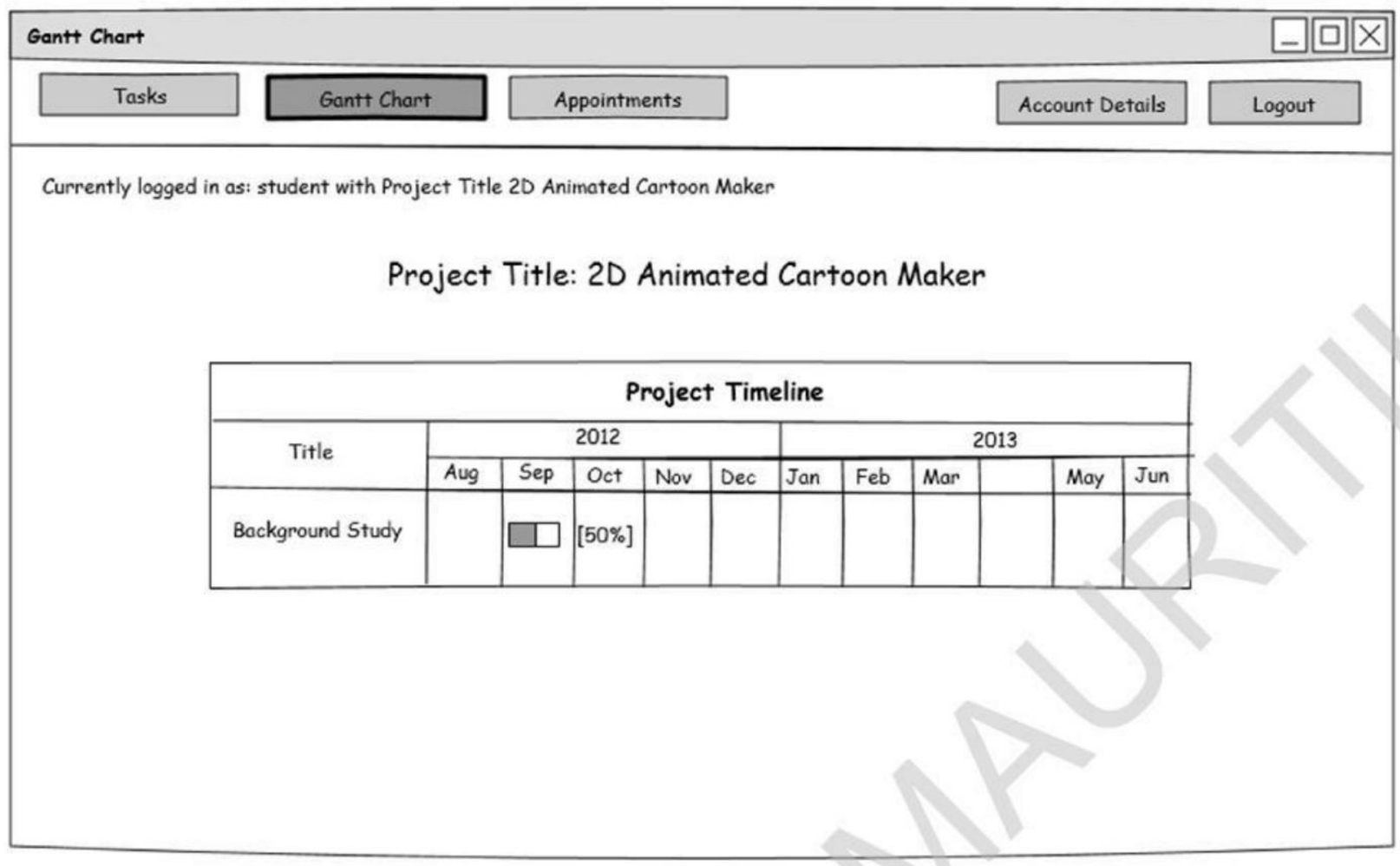

Figure 40: View Gantt chart by student

Clicking on Appointments allows the student to check his supervisor's timetable before sending meeting requests. After the supervisor has accepted or declined the meeting, the student is able to see the response and acts accordingly.

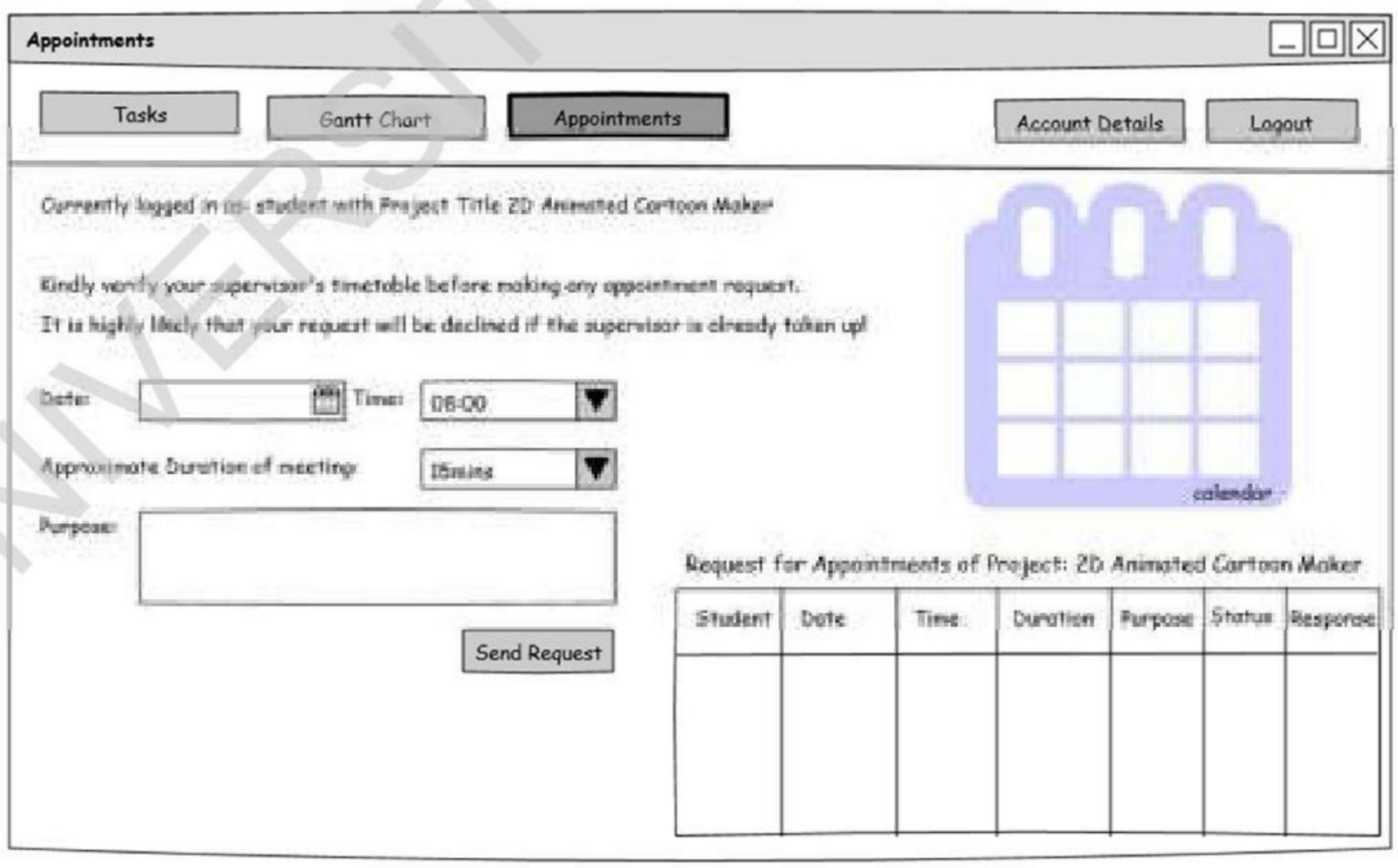

Figure 41: Interface to send appointment requests by student

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Clicking on Account Details allows the student to set his personal information and to change his password. After logging out, he is redirected to the home page.

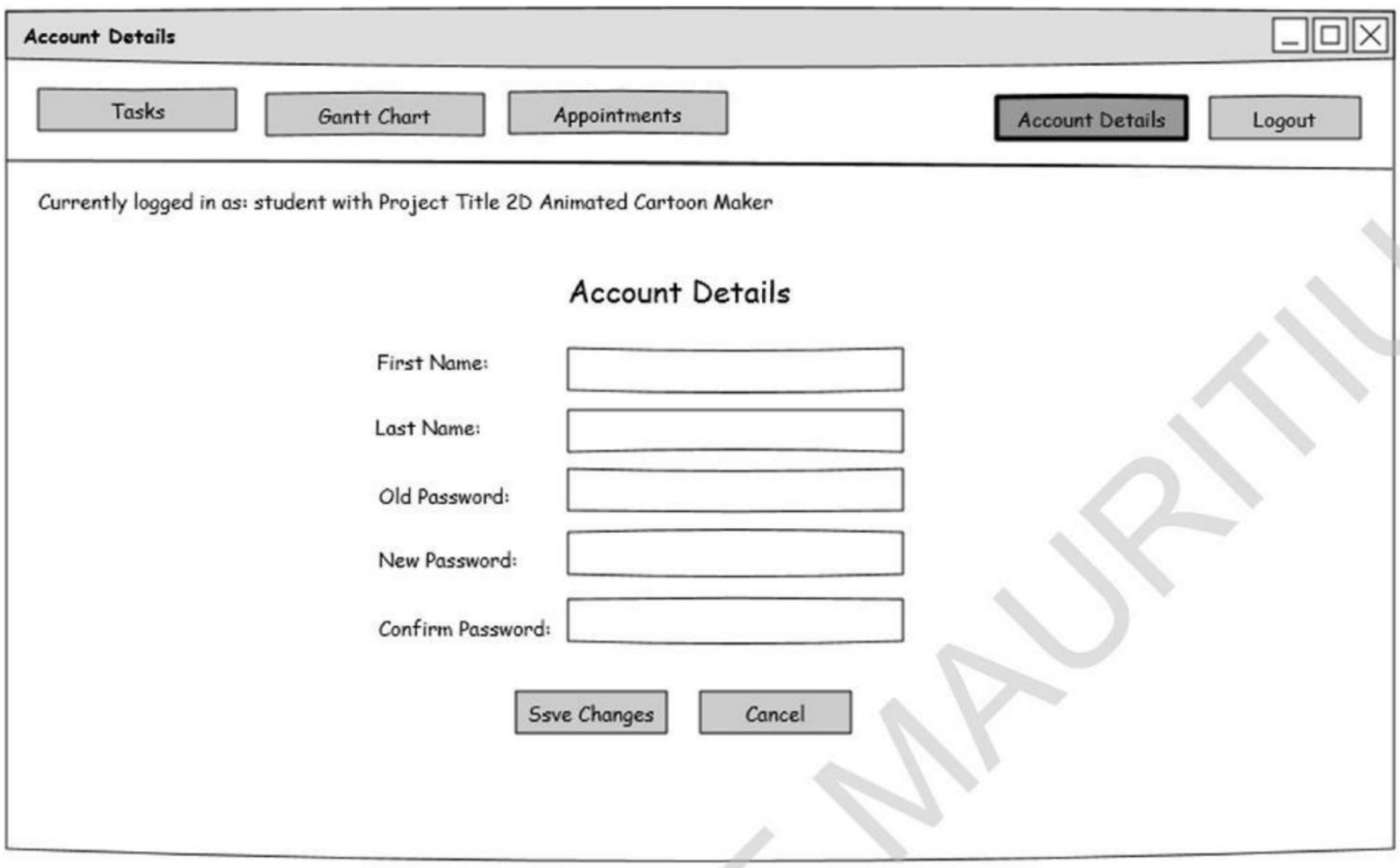

Figure 42: Account Details for student

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CHAPTER 5 – IMPLEMENTATION

Based on the requirements described in the Analysis section and the system's design, a fully functional Web-based application has been developed for the Project Supervision System. This section provides details about the implementation process, issues that arose and how they have been tackled. A description about the development environment, hardware and software configurations used along with the different standards and conventions adopted is also provided.

5.1 Development Environment

The need for a system which is platform-independent has been a major determinant with respect to the choice of technology employed. The Project Supervision System (PSS) is a web-based system developed using Open Source technologies and can therefore be used on any kind of computers, including smartphones; the only requirement is the availability of a browser and an Internet connection.

5.1.1 Hardware Specifications

The main computer used for the development of this system is a Dell N5050 Model laptop with the following specifications:

Processor	Intel® Core™ i3-2350M CPU @ 2.30 GHz
Memory (RAM)	3.00GB
System Type	64-bit
Hard-Disk Drive	450 GB (Although minimum of 2GB of free disk space is sufficient to install required software, and store files for PSS)

Table 15: Hardware Specifications

5.1.2 Software Specifications

Operating System	Windows 7 Home Basic
Database Management System	MYSQL v5.5.27
Web Server	Apache v2.4.2 (Managed through XAMPP for windows v1.7.3)

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Scripting Language(s)	PHP v5.4.6 and JavaScript
Editor	Adobe Dreamweaver CS6 and Notepad++ v6.2.3
Web Browsers	Mozilla Firefox v19.0 and Internet Explorer 8
Libraries	• NuSOAP v1.123 (for Web Service) • JpGraph v3.5.0b1 (For Gantt Chart) • jQuery JavaScript Library v1.9.1 (For Date pickers) • Zend Framework v1.12.2 (For Managing Google Calendars)

Table 16: Software Specifications

5.2 Implementation Issues

5.2.1 Performance

The performance of PSS is indeed crucial for its acceptance among academics and students alike. Based on information obtained through interviews with academics, it was found that the response speed obtained from the Intranet-based system for inputting student marks, managed by the CITS department, was quite slow leading to frustrations among users. Therefore, during the implementation phase of PSS, it was ensured that the scripting codes were optimized and made the minimum number of database calls possible and also avoiding the retrieval of data which is not required. Testing has been performed in parallel with the implementation phase to monitor the response speed obtained from the system.

5.2.2 Reliability

Since final year projects are important among the requirements for obtaining an honours degree, students and supervisors should have access to the PSS at any time, including odd hours. This is because students and academics tend to work on and provide supervision advice both from the university campus and home. PSS shall be hosted on a university-based web-server managed by the CITS department and which is claimed to have a reasonably low down-time. A backup-plan is being envisaged so that in case the primary university server is down, a secondary server managed by a third party can take over. However, this will have to be further discussed due to data privacy and confidentiality issues.

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5.2.3 Usability

PSS has been designed with a simple and user-friendly interface so as to reduce, if not, eliminate user training completely. Controls on different screens were kept to a minimum along with the use of simple and unambiguous language to clearly label the different parts. Each screen has its heading describing its purpose.

5.2.4 Security

PSS provides a secure interface with users accessing the services and their information by firstly keying in their username and password. Users have been assigned different roles, granting them different level of access to the systems. To further enhance security, the passwords are randomly generated by the system (thus avoiding users to make use of easily-guessable passwords) and also are encrypted using MD5 before database storage. Measures have also been taken to prevent SQL Injection attacks through proper sanitization of SQL queries.

5.3 Standards and Conventions

To ensure that PSS is easily maintainable, proper coding standards and conventions were adopted. These also have the effect of improving code readability.

5.3.1 Coding Indentation

The codes written were properly indented to improve clarity and ease their understanding.

5.3.2 User of Comments

Comments have been used to describe complex parts of the codes so that the programmers can easily recall what was done and also, in case another programmer takes over, he will be able to independently understand the codes.

5.3.3 Use of white spaces/blank lines

White spaces and blank lines have been used wherever needed to separate chunks of codes for enhancing readability

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5.3.4 Variable Declarations

Variable names were chosen contextually, therefore making it easier to understand their purposes and what data they will be holding. The Camel-Case notation was used for naming the variables.

5.4 Implementation of Modules/Components

A top-down approach was followed in the implementation of the Project Supervision System. The main modules of the system along with their sub-modules are depicted in Figure 42.

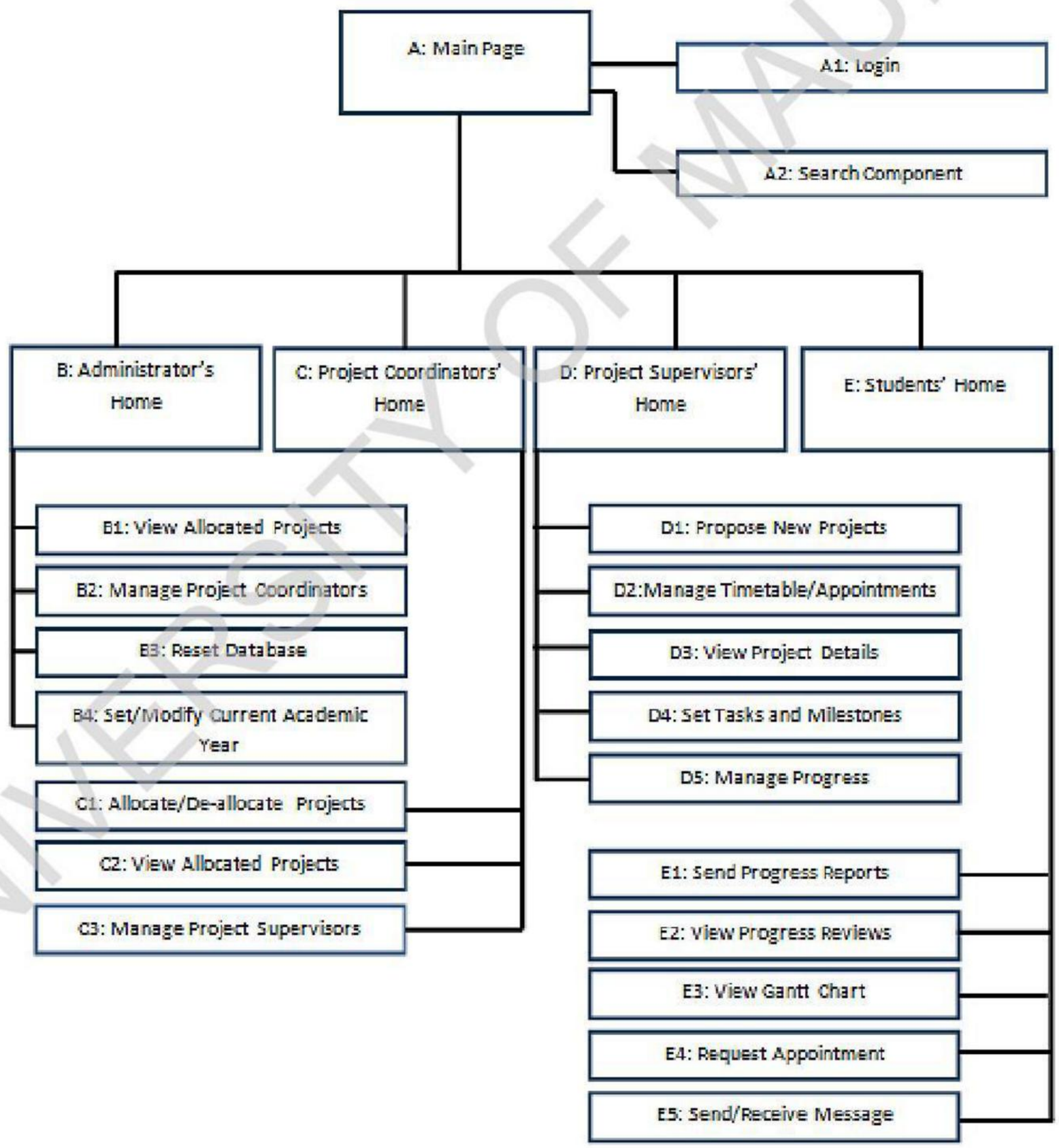

Figure 43: The System's Modules and Sub-modules

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The sections that follow provide the implementation details of the above modules/components. The interface has been simplified and most CSS codes were disabled while taking screenshots so as to provide clearer printouts for the purpose of this report.

5.4.1 A: Main Page

The main page, named *index.php* is the first page that users are presented to when using PSS. It consists of two other components, namely, the Login and the Search Link as shown in Figure 44.

Figure 44: Login Page

5.4.2 A1: Login

In order to ensure that the text boxes for the login are not left blank and that the correct username (which is the user's UOM provided email address) is input, JavaScript validation, including Regular Expression is used.

```
<input type="submit" value="Login" onclick='return validateLogin()'/>
```

Figure 45: Function Call

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The JavaScript function for the validation is shown in Figure 46.

```
function validateLogin(){//function to validate username/password
    var username=document.getElementById('idemail').value;
    var password=document.getElementById('idpass').value;
    if((username.length==0)||(password.length==0)){//ensure that both username and passwords not blank
        document.getElementById('errormsg').innerHTML="Please DO NOT leave username/password blank!";
        return false;
    }
    else{
        var filter=/^[a-z]{1}[a-z\.0-9]{2,20}(@(umail\.)*uom\.ac\.mu)$/;
        var result=filter.test(username);
        if(result==true){//login respects email format...
            return true;
        }
        else{//email doesnt match format
            document.getElementById('errormsg').innerHTML="Only DOM-based email addresses are accepted";
            return false;
        }
    }
return false;//we have not met the validating conditions, so return false
}
```

Figure 46: JavaScript function for the validation

The Regular Expression constructed for validating email addresses ensures that only UOM-provided email addresses are allowed.

```
var filter=/^[a-z]{1}[a-z\.0-9]{2,20}(@(umail\.)*uom\.ac\.mu)$/;
```

Figure 47: Regular Expression to validate email addresses

Only two possible formats are thus valid; for example: a.meetoo@uom.ac.mu for an academic and bibi.beekhy@umail.uom.ac.mu for a student.

When the login data is submitted to the server (*login_process.php*), sessions are created to store the username along with the role of the user (role 1 is student, 2 supervisor, 3 project coordinator, 4 administrator).

Sample code to check the user's authorization level is shown in Figure 48.

```
session_start();
if (!isset($_SESSION['role'])){
    header('Location: login.php?error=You need to log in before viewing that page!');
}
else if($_SESSION['role']!=4){
    header('Location: login.php?error=You need to log in as the Administrator before viewing
}
```

Figure 48: Code to check the user's authorization level

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5.4.3 A2: Search Component

The Search Component is available by clicking on the icon or text as shown in Figure 49.

Figure 49: Link to WebService

The hyperlinks opens the page *client.php* which in fact provides an interface to make a web service call to the server. Since project descriptions can be useful for both students and staff from the University of Mauritius but also to others in the computing field and who may develop their own applications making use of this search facility, a Web Service, using the NuSOAP library has been implemented.

The interface for the Web Service as seen on client.php is shown in Figure 50.

Figure 50: Interface for the Web Service

This search service is publicly available and requires no login. Users can key in one or more search terms and choose where to search for the term, that is, in the project titles, whole description or project areas.

```
require_once('lib/nusoap.php');
$result="";
if(isset($_GET['txtsearch'])){
    $searchval=$_GET['txtsearch'];
    $searchoption=$_GET['soption'];

    $client = new nusoap_client('http://127.0.0.1:8080/zpms2/zlogin/projectws/server.php?wsdl', true);
    $result = $client->call('search', array('searchval' => $searchval,'searchoption'=>$searchoption));
```

Figure 51: Web Service Call

The Web Service is called as shown in Figure 51 and the response, obtained in XML format is stored in the variable *$result*.

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Using JavaScript, the XML is transformed with XSL to produce the table of result in Figure 52.

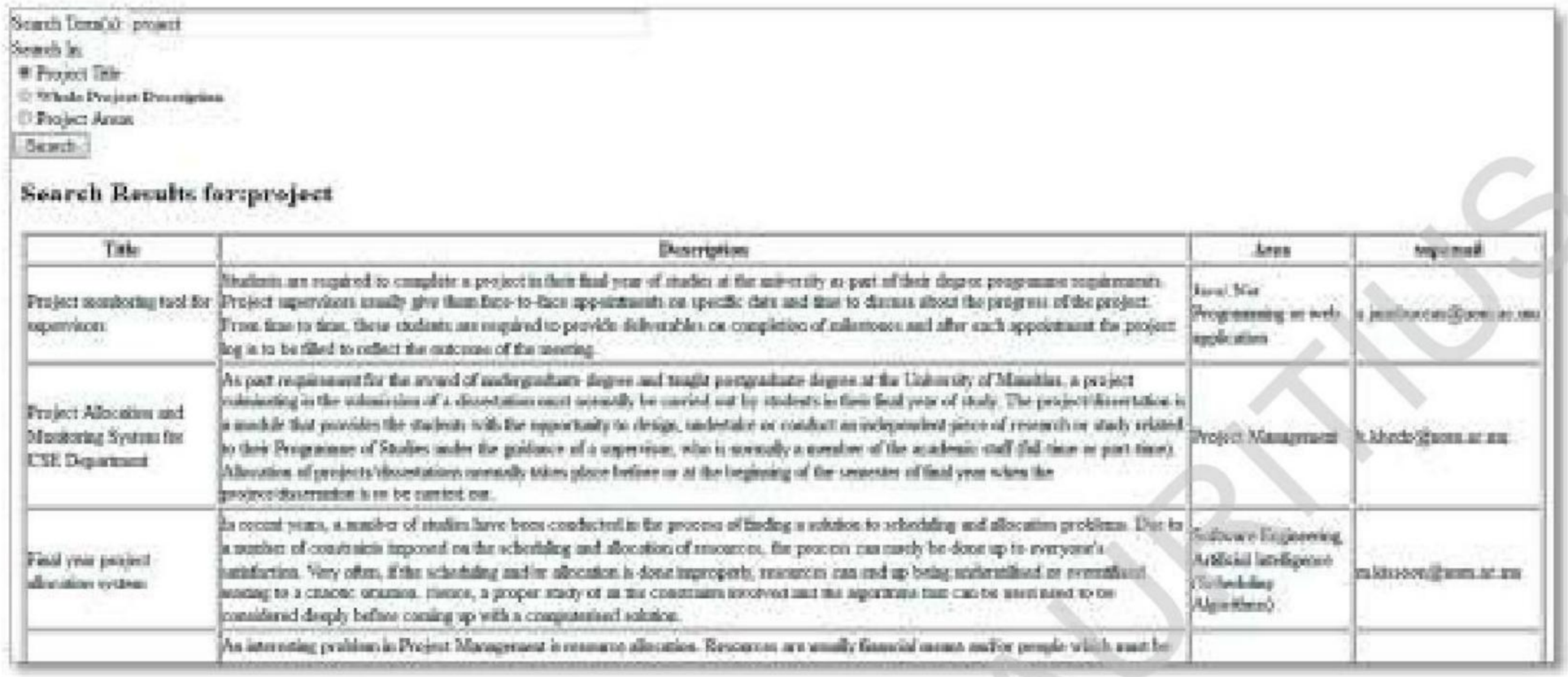

Figure 52: Results obtained when a search is carried using the Web Service

The XSL used is shown in Figure 53.

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<xsl:stylesheet version="1.0"
xmlns:xsl="http://www.w3.org/1999/XSL/Transform">
<xsl:template match="/">
  <html>
  <body>
  <h2>Search Results for:<xsl:value-of select="//searchterms"/></h2>
  <table border="1">
    <th>Title</th><th>Description</th><th>Area</th><th>supemail</th>
        <xsl:for-each select="results/result">
        <tr>
          <td><xsl:value-of select="title"/></td>
          <td><xsl:value-of select="description"/></td>
          <td><xsl:value-of select="parea"/></td>
        <td><xsl:value-of select="supervisoremail"/></td>
        </tr>
      </xsl:for-each>
  </table>
  </body>
  </html>
</xsl:template>
</xsl:stylesheet>
```

Figure 53: Stylesheet used to produce the results table

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On the Web Service Server page, the search function is invoked and based on the search option selected through radio buttons on the client, the appropriate SQL query is constructed as shown in Figure 54.

```
function search($searchval,$searchoption){
    include ('zdbconnect.php');
    $sql="";
    $str='<?xml version="1.0" encoding="ISO-8859-1" ?><results>';
    if($searchoption=='rtitle'){
        $sql="select * FROM projectallocation WHERE MATCH (ptitle) AGAINST ('$searchval')";
        //$sql="select * FROM projectallocation WHERE ptitle LIKE '%$searchval%'";
    }
```

Figure 54: SQL query construction based on selection

As it can be seen above, two SQL queries were constructed, a previous version used the 'LIKE' while the current version makes use of 'MATCH AGAINST'. The difference lies in the fact that with the 'LIKE' the search terms have to be contiguous to get a match and also the results are not sorted. With the 'MATCH AGAINST', there is no need for contiguity and also, results are sorted based on relevance. In order to enable this in MYSQL, the table created had to be altered to update its default engine from innoDB to MYISAM engine and FULL-TEXT indexes were added to the necessary fields.

The FULL-TEXT indexes were added through PhpMyAdmin's interface as shown in Figure 55.

Indexes:

Action	Keyname	Type	Unique	Packed	Field	Cardinality	Collation	Null	Comment
	PRIMARY	BTREE	Yes	No	pid	203	A		
	fulltextindex	FULLTEXT	No	No	supname	1			
					supemail	1			
					parea	1			
					ptitle	1			
					pdescription	1			
					pproblemdefinition	1			
					paimobjective	1			
					presearchoutput	1			
					psofthard	1			
	ptitle	FULLTEXT	No	No	ptitle	1			
	parea	FULLTEXT	No	No	parea	1			

Figure 55: Full-Text Indexes added to necessary fields

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5.4.4 B: Administrator's Home

There is one administrator for the system and he/she is responsible for managing project coordinators, resetting the data stored in the database and also for setting the current academic year as shown in Figure 56.

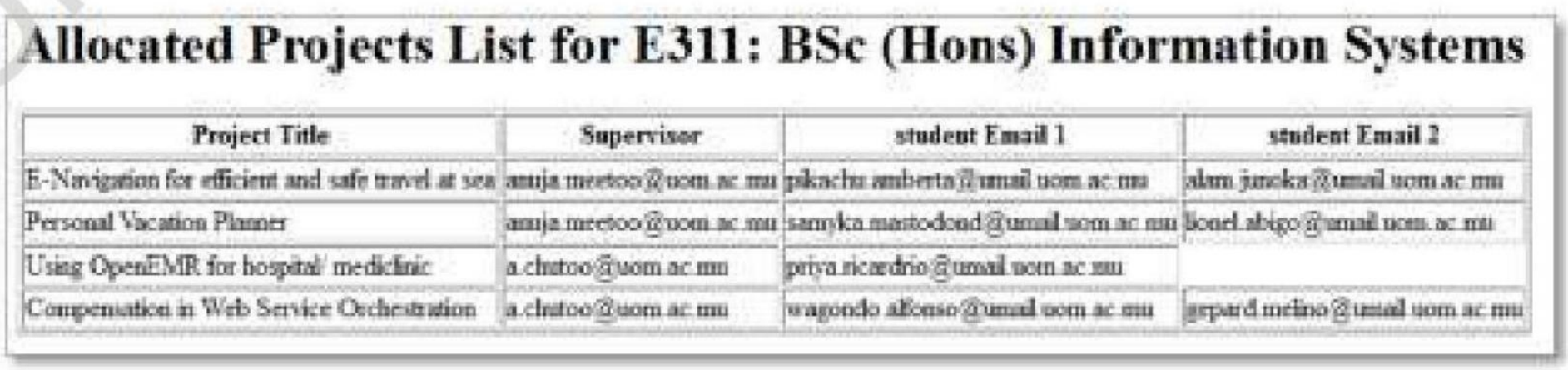
Figure 56: Interface used by Administrator

5.4.5 B1: View Allocated Projects

The administrator is only allowed to view allocated projects for all the courses as shown in Figure 57.

Figure 57: Allocated Projects for the different batches

Choosing a particular course lists the details of the allocated projects as shown in Figure 58.



Allocated Projects List for E311: BSc (Hons) Information Systems

Project Title	Supervisor	student Email 1	student Email 2
E-Navigation for efficient and safe travel at sea	anuja.meetoo@uom.ac.mu	pikachu.amberta@umail.uom.ac.mu	alan.jancka@umail.uom.ac.mu
Personal Vacation Planner	anuja.meetoo@uom.ac.mu	samyka.mastodond@umail.uom.ac.mu	lionel.abigo@umail.uom.ac.mu
Using OpenEMR for hospital/ medicliniic	a.chutoo@uom.ac.mu	priya.ricardrio@umail.uom.ac.mu	
Compensation in Web Service Orchestration	a.chutoo@uom.ac.mu	wagondo.alfonso@umail.uom.ac.mu	gerard.melino@umail.uom.ac.mu

Figure 58: Allocated Projects for a specific course

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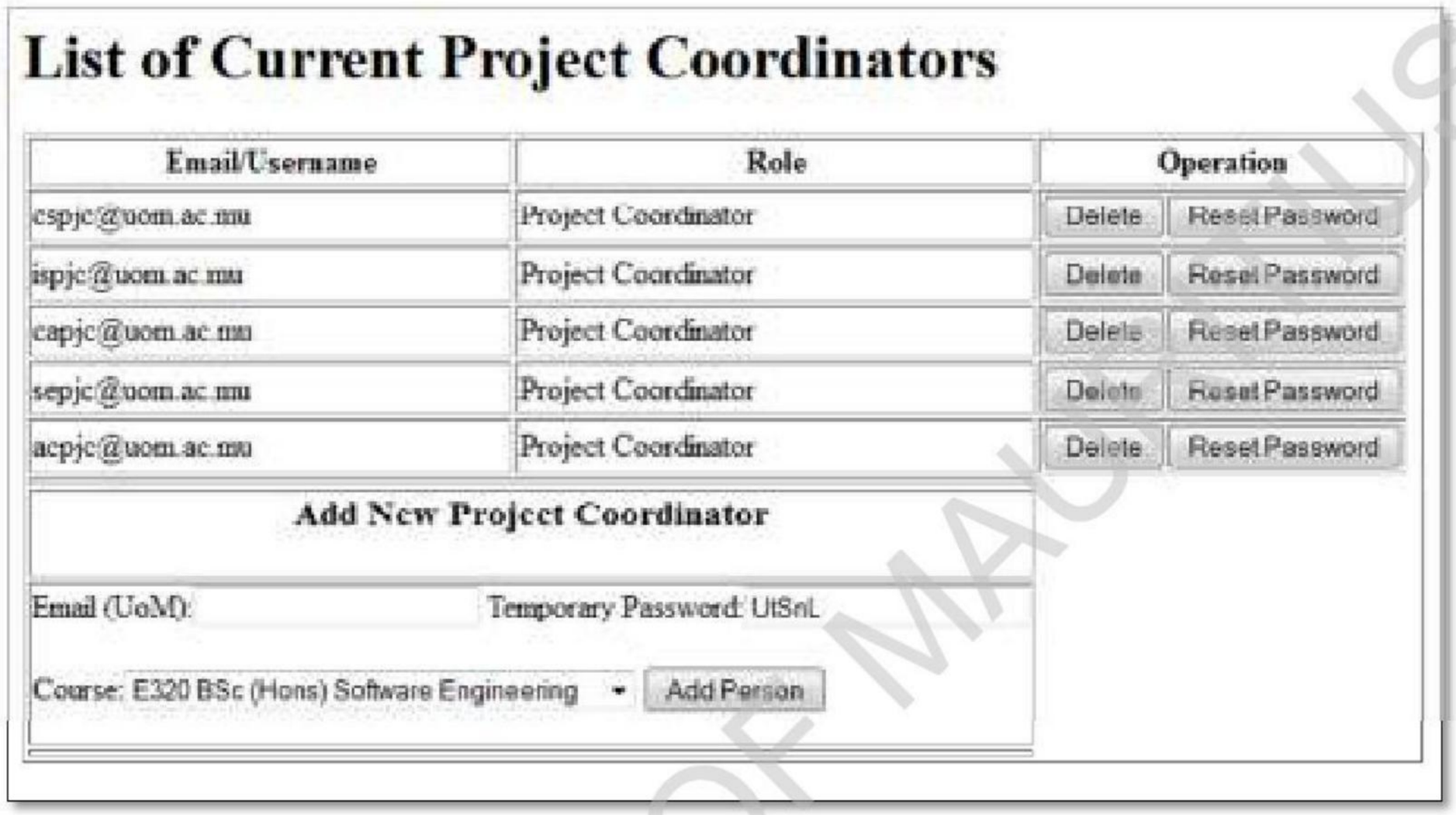
5.4.6 B2: Manage Project Coordinators

The Manage Project Coordinators page enables the administrator to: View/Delete/Reset Password of current project coordinators. He can also add new project coordinators. This is shown in Figure 59.



List of Current Project Coordinators

Email/Username	Role	Operation	
cspjc@uom.ac.mu	Project Coordinator	Delete	Reset Password
ispjc@uom.ac.mu	Project Coordinator	Delete	Reset Password
capjc@uom.ac.mu	Project Coordinator	Delete	Reset Password
sepjc@uom.ac.mu	Project Coordinator	Delete	Reset Password
acpjc@uom.ac.mu	Project Coordinator	Delete	Reset Password

Add New Project Coordinator

Email (UoM): Temporary Password: UtSnL

Course: E320 BSc (Hons) Software Engineering Add Person

Figure 59: Manage Project Coordinators

The 'Delete' button removes the record for the specific project coordinator while the 'Reset Password' button generates a new random password for the project coordinator and send him the password through email as shown in Figure 60.

```
include ('randomizetext.php');
$newpass=rand_string(5);
$sql = "UPDATE logindata set password ='$newpass' WHERE email1 = '$resetval'";
echo $sql;
$res = mysql_query($sql, $conn);

//-----------send email to provide user with the new (resetted password)
$to = $resetval;
$subject = "Account Password Reset PMS System";
$message = "Dear Colleague, Your account's password has been reset by the Administrator on
            the PMS; The new login details: Email: ".$resetval." & Password: ".$newpass;
$from = "admin@uompms.com";
$headers = "From:" . $from;
mail($to,$subject,$message,$headers);
header('Location: adminmanagepcps.php?delresetconfirm=Password for
                                Account '.$resetval.' has Been Reset!');
```

Figure 60: Mail sent when password is reset

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The page *randomisetext.php* included above will generate a random string of text, 5 characters in length. The codes in *randomisetext.php* have been obtained from http://www.lateralcode.com/creating-a-random-string-with-php/.

5.4.7 B3: Reset Database

The Reset Database page includes a list of clearable/resettable data as shown in Figure 61.

Clear All Appointments	Clear
Clear All Tasks	Clear
Clear All Project Allocations	Clear
Clear All File Uploads	Clear
Clear All Reviews	Clear
Reset The WHOLE DATABASE	Clear

Figure 61: Reset Database and Tables

To prevent accidental/unintentional operations, confirmation messages are displayed before an operation is executed. An example of such a confirmation message is shown in Figure 62.

Figure 62: Confirmation message before database is reset

```
<td><a onclick="javascript:return confirm('Are you sure you want to RESET THE WHOLE DATABASE?')"
    href="clearallwholedatabase.php">Clear</a></td>
```

Figure 63: Function call to show confirmation message

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5.4.8 B4: Set/Modify current Academic Year

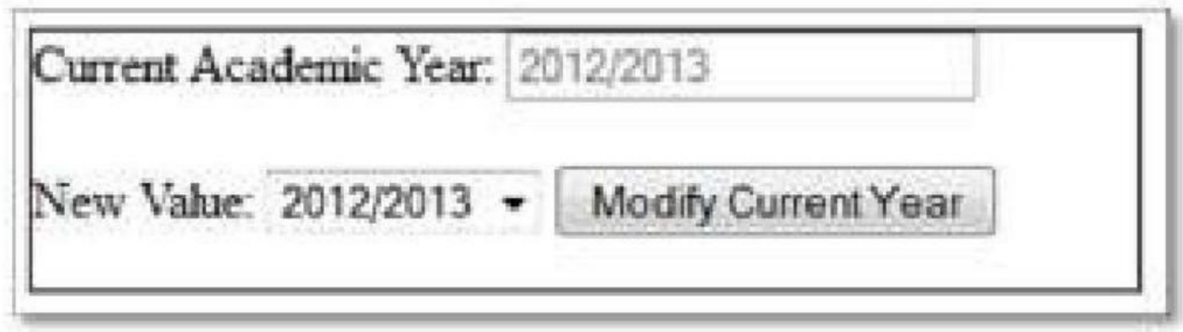

Figure 64: Interface to change academic year

At the start of every academic year, before academics start inputting projects' descriptions into the system, the administrator has to update the current academic year. This is done so that project descriptions inserted by the project supervisors automatically include the current academic year in their record. Its importance is for displaying only projects for the current academic year when listing project details. AJAX is used for the update so as to avoid a complete page reload.

```
<form name="yearform">
    <?php
    $sql = "SELECT * from currentyear";
    $res = mysql_query($sql, $conn);
    $row=mysql_fetch_array($res);
    ?>
    Current Academic Year: <input type="text" name="currentacadyear" disabled="true"
                    id="txtyear" value="<?php echo $row['acadyear'];?>"/><br/><br/>
    New Value:
    <select name="slyear" id="idslyear">
        <option value="2012/2013">2012/2013</option>
        <option value="2013/2014">2013/2014</option>
        <option value="2014/2015">2014/2015</option>
        <option value="2015/2016">2015/2016</option>
        <option value="2016/2017">2016/2017</option>
        <option value="2017/2018">2017/2018</option>
        <option value="2018/2019">2018/2019</option>
        <option value="2019/2020">2019/2020</option>
        <option value="2020/2021">2020/2021</option>
    </select>
    <button onclick="return ajaxUpdate()">Modify Current Year</button>
</form>
```

Figure 65: Function Call to modify current academic year

The select input includes years till 2020/2021 since the lifespan of PSS requires maintenance every three years when programmes offered by the CSE department are reviewed.

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```
function ajaxUpdate(){
    var e = document.getElementById("idslyear");
    var val= e.options[e.selectedIndex].value;
    ypackage=new XMLHttpRequest();
    var url="updateyear.php?newyear="+val;
    ypackage.open("GET", url, true);
    ypackage.onreadystatechange=displayresult;
    ypackage.send(null);
    return false;
}

function displayresult(){
    if (ypackage.readyState==4 && ypackage.status==200){
        var answerStr=ypackage.responseText;
        document.getElementById('txtyear').value=answerStr;
    }
}
```

Figure 66: Function ajaxUpdate()

The `ajaxUpdate()` function retrieves the value selected from the dropdown and pass it through the URL to the server asynchronously. The response is inserted into the text box with id *txtyear* which is disabled for manual manipulation by the user.

5.4.9 C: Project Coordinator's Home

Project coordinators are redirected to the Project Coordinator's Home Page upon successful login. They can allocate/de-allocate projects to students and can also manage (Add/Modify/Delete) Supervisors.

5.4.10 C1: Allocate/De-Allocate Projects

Project Coordinators can allocate projects only for their respective course as shown in Figure 67.

Figure 67: Project Allocation by project coordinators

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The combo box for project is populated from values from the database as shown in Figure 68.

```
<select name="projid">
    <?php
    //we populate the select with values from table course
    include ('adbconnect.php');
    $sql1 = "SELECT * FROM projectAllocation WHERE allocated=false AND cid='$coursecode'";
    $resecourse = mysql_query($sql1, $conn);
    while($row = mysql_fetch_array($resecourse)){
        echo "<option value='".$row['pid']."'>".$row['supemail']."-".$row['pid']."-".$row['ptitle']."</option>";
    }
    ?>
</select>
```

Figure 68: Combo box is populated from values found in database

A project can be allocated to one or two students. For De-allocation of projects, this can be done while viewing allocated projects (see C2).

5.4.11 C2: View Allocated Projects & De-allocate Projects

Project Title	Supervisor	student Email 1	student Email 2	De-Allocation
Using OpenEMR for hospital/ medicalic	[illegible]	[illegible]		De-Allocate
E-Navigation for efficient and safe travel at sea	[illegible]	[illegible]	[illegible]	De-Allocate
Project Allocation and Monitoring System for CSE Department	[illegible]	[illegible]	[illegible]	De-Allocate
Online Helpdesk for Campus-based facilities	[illegible]	[illegible]		De-Allocate
Framework for Testing Web Applications	[illegible]	[illegible]	[illegible]	De-Allocate

Figure 69: View allocated projects & de-allocate projects

For each row in the table above, a button is added along with an onclick event which sends the project's *Id* and *title* as parameter to a JavaScript function.

```
<button onclick='return jsdeallocate(";echo $row['pid'];echo",\"".$row['ptitle'];echo"\")'>De-Allocate</button>
```

```
function jsdeallocate(pid,ptitle){
    val=confirm("Are you sure you want to deallocate the project "+ptitle +"?");
    if(val==true){
        document.getElementById('deallocatepidval').value=pid;
        return true;
    }
    else{
        return false;
    }
}
```

Figure 70: Function jsdeallocate() taking as parameter project ID an project title

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In *process_deallocation.php*, the following queries are executed:

```
$sql1="SELECT email1,email2 FROM logindata WHERE pId = $deallocatepidval";
echo $sql1;
$res1 = mysql_query($sql1, $conn);
$row1 = mysql_fetch_array($res1);
$email1=$row1['email1'];
$email2=$row1['email2'];

$sql2 = "DELETE FROM logindata WHERE pId = $deallocatepidval";
$res2 = mysql_query($sql2, $conn);

$sql3= "UPDATE studentlist set allocated=0 WHERE email='$email1' OR email='$email2'",
$res3 = mysql_query($sql3, $conn);

$sql4="UPDATE projectallocation set allocated=0 WHERE pid=$deallocatepidval";
$res4 = mysql_query($sql4, $conn);
```

Figure 71: Queries executed

An email is also sent to the student(s) to inform the latter that the project has been de-allocated from him/her/them. The code for sending the email is shown in Figure 72.

```
//------------send email to inform the students about deallocation
$to = $email1.','.$email2;
$subject = "Project Deallocation";
$message = "Dear Student(s), please note that you have been de-allocated from your project.";
$from = "admin@ucmpms.com";
$headers = "From:" . $from;
mail($to,$subject,$message,$headers);
//--------end of the send email
header('Location: allocated_deallocate_projects.php?course=',$course.'&deallocateconfirm=Successfully
```

Figure 72: Codes to send email to student

5.4.12 C3: Manage Project Supervisors

The Manage Project Supervisors is almost the same as the module of Manage Project Coordinators except that when adding a new project supervisor, there is no course attached to the supervisors since they are allowed to supervise projects from all the courses. Therefore the same codes have been used and the session variable $_SESSION['role'] was checked to customise links and other content depending whether an administrator or a project coordinator is viewing the page. An example of this process is shown in Figure 73.

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```
if($_SESSION['role']==4){//we are dealing with an admin
    echo "<li><a href='adminhome.php'> Administrator's Home</a></li>";
}
else if($_SESSION['role']==3){//we are dealing with a project coordinator
    echo "<li><a href='projectcoordinatorhome.php'> Project Coordinator's Home</a></li>";
    echo "<li><a href='projectallocation.php'> Manage Project Allocation</a></li>";
}
```

Figure 73: User is redirected based on role

5.4.13 D: Project Supervisor's Home

Once authenticated, a supervisor is redirected to the Supervisor's Home page. The page provides links to input new projects into the system and Manage Calendar of Activities (Timetable). Also, a summary of all projects offered by the latter, including information such as whether a project has been allocated and if yes, to whom. This is shown in Figure 74.

E318 BSc (Hons) Computer Science

Project Id	Title	Allocated?	Students			
			ID	Name	Email	
70	A Self-Adaptive Algorithm for the long-term Car Pooling Problem	Yes	1218422	Emma Tandine	emma.tandine@mail.uom.ac.mu	Manage
71	Real-Time Prediction of Traffic Accidents	No				

E311 BSc (Hons) Information Systems

Project Id	Title	Allocated?	Students			
			ID	Name	Email	
1	E-Navigation for efficient and safe travel at sea	Yes	1218437	Pikachu Auberta	pikachu.auberta@mail.uom.ac.mu	Manage
			1263213	Alam Janoka	alam.janoka@mail.uom.ac.mu	
2	Personal Vacation Planner	No				

Figure 74: Information about projects for all projects are shown

For projects that have already been allocated, additional information is provided along with a 'Manage' button.

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5.4.14 D1: propose new projects

Accessible via a hyperlink from the Surpervisor's home page, this module makes use of a form to enable supervisors to easily type/paste project description and other details. The current academic year is automatically added as shown in Figure 75 whereby the current year is first retrieved from database and then used in an INSERT query.

```
include ('zdbconnect.php');
$title = $_GET['txtptitle'];
$course = $_GET['slcourse'];
$desc = $_GET['txadescription'];
$supemail=$_SESSION['uname'];

        //find out the current year
        $sql2 = "SELECT * from currentyear";
        $res2 = mysql_query($sql2, $conn);
        $row2=mysql_fetch_array($res2);
        $currentYear=$row2['acadyear'];
        //end of find out current year
$sql = "INSERT INTO projectallocation(ptitle,cid,pdescription,supemail,acadyear)
VALUES ('$title','$course','$desc','$supemail','$currentYear')";
mysql_query($sql, $conn);
header('Location: zsupervisorprojinput.php?success=true');
```

Figure 75: The current academic year is automatically added to each proposed project

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5.4.15 D2: Manage Timetable/Appointments

This module enables supervisors to firstly add events such as lectures and lab sessions to their calendar. And most importantly to view, accept, decline requests for appointment from students. To display the calendar, Google Aps' APIs have been used.

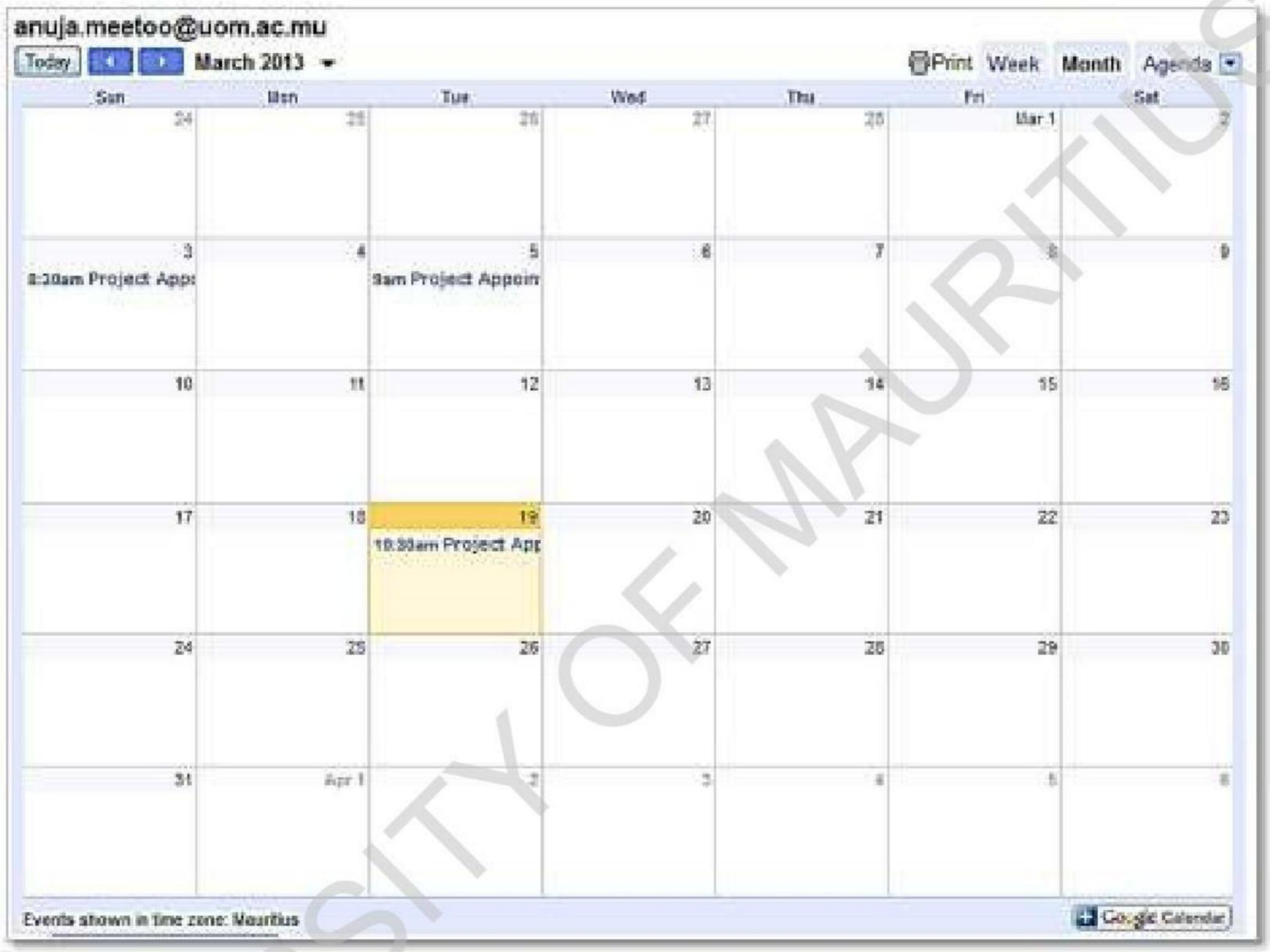

Figure 76: Calendar for each supervisor

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To use the Google API, the Zend Framework along with some of its classes has been loaded using the codes shown in Figure 77.

```
/**
 * @see Zend_Loader
 */
require_once 'Zend/Loader.php';

include ('caldbconnect.php');
/**
 * @see Zend_Gdata
 */
Zend_Loader::loadClass('Zend_Gdata');

/**
 * @see Zend_Gdata_AuthSub
 */
Zend_Loader::loadClass('Zend_Gdata_AuthSub');

/**
 * @see Zend_Gdata_ClientLogin
 */
Zend_Loader::loadClass('Zend_Gdata_ClientLogin');

/**
 * @see Zend_Gdata_HttpClient
 */
Zend_Loader::loadClass('Zend_Gdata_HttpClient');

/**
 * @see Zend_Gdata_Calendar
 */
Zend_Loader::loadClass('Zend_Gdata_Calendar');
//-------------
```

Figure 77: Zend Framework and its classes loaded to allow use of Google API

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Each supervisor has one calendar for PSS created for them. Each time they load the page, a quick check is done to ensure that their calendar has already been created. If yes, a reference to it is kept, else a new calendar is created and a reference is kept as shown in the codes in Figure 78.

```
//======
$gc = new Zend_Gdata_Calendar($client);
//========

//get a list of calendars
try {
$listFeed= $gc->getCalendarListFeed();
} catch (Zend_Gdata_App_Exception $e) {
echo "Error: " . $e->getMessage();
}

//look into each calendar if they have a particular title
$existanceFlag=false;
foreach ($listFeed as $calendar) {
    if($calendar->title == $uname){
        $useCalendarFeed = $calendar->content->src;
        //echo $useCalendarFeed.'<br/>';
        $existanceFlag=true;
    }
}
//========
//create calendar if it does not already exist
if($existanceFlag==false){
    //create a new calendar
    $appCal = $gc->newListEntry();
    $appCal->title = $gc->newTitle($uname);//name of calendar
    $own_cal = "http://www.google.com/calendar/feeds/default/owncalendars/full";
```

Figure 78: Codes to create calendar

All request for appointments are also displayed on the same page. This is shown in Figure 79.

Figure 79: All appointment requests are listed

By default, all requests have the status: Undecided. Supervisors can change the status by clicking on the appropriate radio button (Approve/Decline). Using AJAX, this status

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changed is updated in the database. The students see their request's status from their own page but the supervisors can choose to notify the student also by email if they desire.

5.4.16 D3: View Project Details

Figure 80: To view project details

Task Name	Date&Time Uploaded	Reviews		
		Comment	Date/Time	Manage
Background Study	2013-03-19 21:08:31	Dear Student, I had a look. The background seems fine so far. You should consider different technologies available and document them as well.	2013-03-19 21:14:29	X Edit
		I forgot to mention, we need to meet and discuss some other ideas. Send me an appointment request for next week.	2013-03-19 21:15:50	X Edit
		comment		

Figure 81: To view comments for each task

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5.4.17 D4: Set Tasks and Milestones & D5: Manage Progress

The supervisor is able to select a task, add its start date and end date. On clicking the 'Save' button, the task is added to the table, and also to the project timetable. The tasks details are updatable and are reflected in the timeline, if ever the supervisor wishes to do so. The Gantt chart has been generated using the JpGraph library. A Datepicker is used for the date.

Figure 82: Datepicker to select start date and end date for each task

```
<script src="libraries/jquery/jquery-1.9.1.js"></script>
<script src="libraries/jquery/jquery-ui.js"></script>
<link rel="stylesheet" href="libraries/jquery/jquery-ui.css" />

<script>
   $(function() {
       $( ".datepicker" ).datepicker({ dateFormat: "yy-mm-dd" });
   });
</script>
```

Figure 83: Code for the datepicker

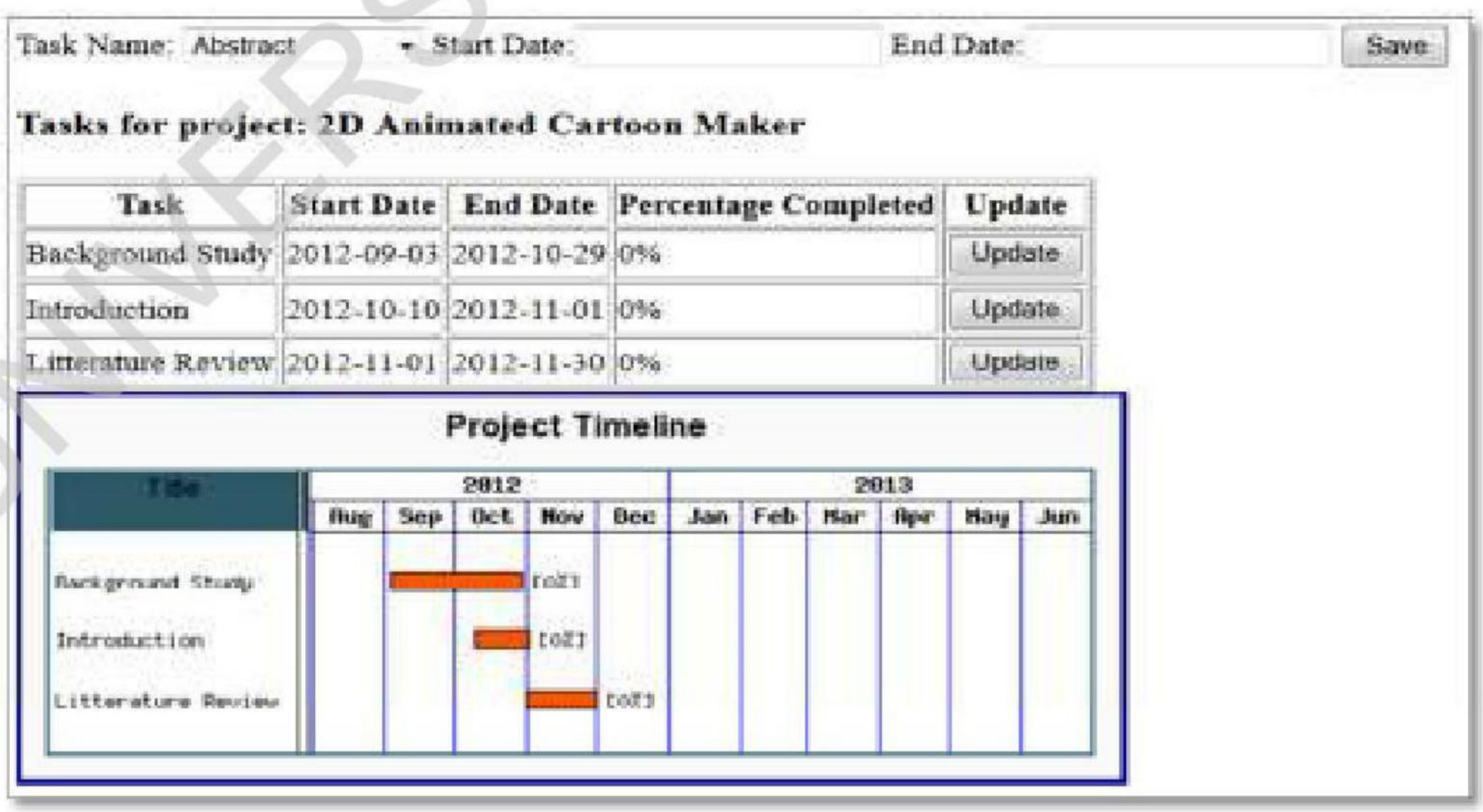

Figure 84: The Gantt Chart generated using JpGraph library

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After checking a task, the supervisor is able to update the percentage completion of the work, which is then updated in the timeline as well, with a green progress bar, as shown in Figure 85.

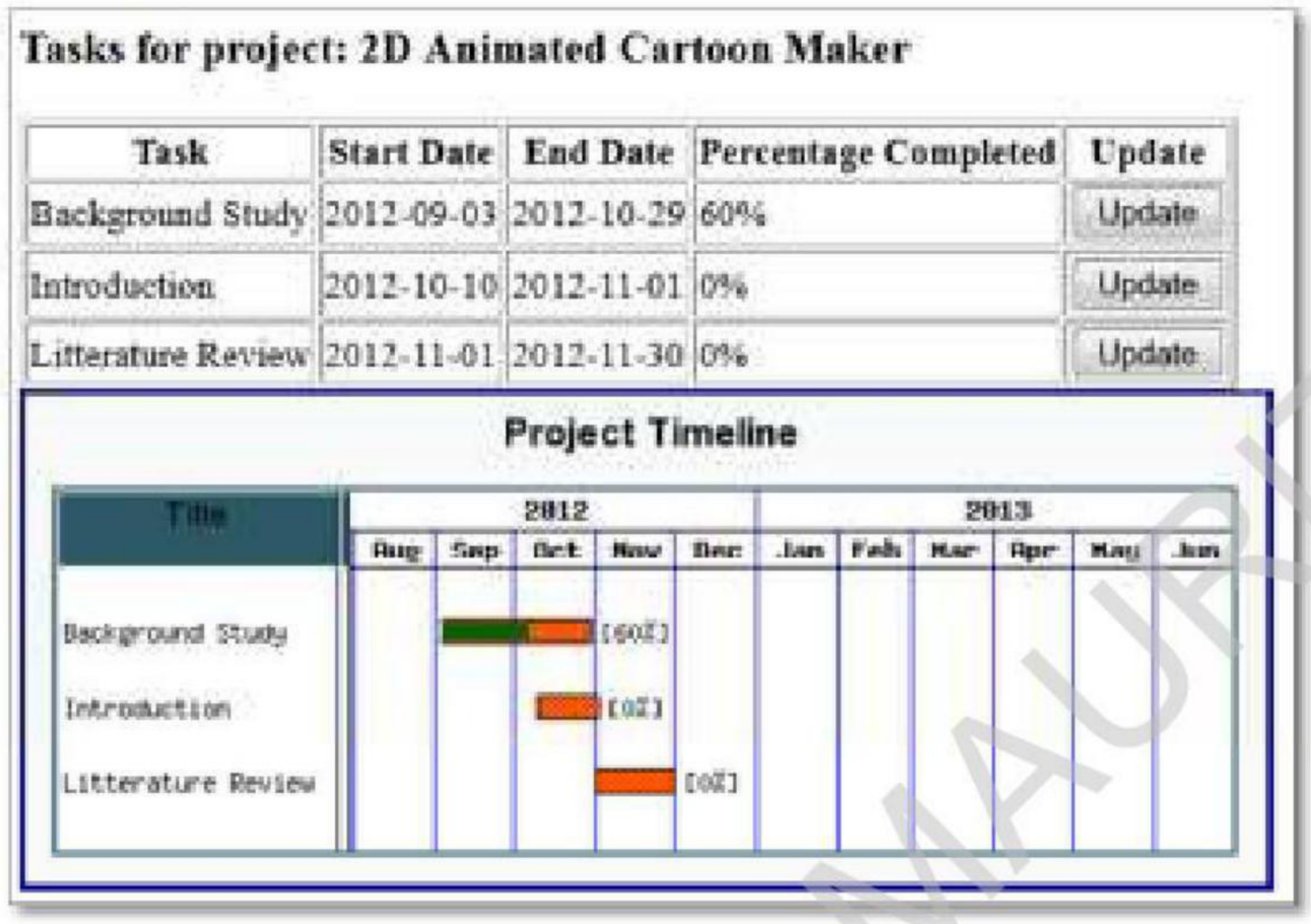

Figure 85: Progress is updated accordingly

JpGraph already contains the classes to draw the generated timeline. The Gantt chart is rendered as an image. The codes are shown in Figure 86.

```
<?php

$_SESSION['pid']=$pid;
// The name of the graph script file (change as needed!)
$_graphfilename = 'supGanttGenerator.php';

// This is the filename of this HTML file
global $_wrapperfilename;
$_wrapperfilename = basename (__FILE__);

// Create a random mapname used to connect the image map with the image
$_mapname = '__mapname'.rand(0,1000000).'__';

// This is the actual graph script
require_once ($_graphfilename);

// Get hold of the image map to include it in the HTML page
$imgmap = $graph->GetHTMLImageMap($_mapname);
echo $imgmap;
?>

<?php
// We now create the <img> tag
$imgtag = $graph->GetCSIMImgHTML($_mapname,$_graphfilename);
echo $imgtag;
?>
```

Figure 86: Codes provided by JpGraph library to display the Gantt chart

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The task list in the dropdown is retrieved from database for the specific project as shown in the codes in Figure 88. These tasks are specified by the project's supervisor.

```
<select name="seltask">
<?php
    //we populate the select with values from table gantt  and tasklist
    include ('zdbconnect.php');
    $sql = "SELECT * FROM gantt INNER JOIN
            tasklist ON gantt.taskid = tasklist.taskid
            WHERE pid='$teamId'";

    $restask = mysql_query($sql, $conn);
    while($row = mysql_fetch_array($restask)){
        echo "<option value='".$row['taskid']."'>".$row['taskname']."</option>";
    }
?>
</select>
```

Figure 88: Codes to populate the dropdown list with tasks

Once uploaded, two steps are executed: The file details are stored in the database and secondly, the file in copied into the folder 'uploads'.

```
if(isset($_POST['btnTaskUpload'])){
    $teamId = $pid;
    $description=$_POST['txadescription'];
    $taskid=$_POST['seltask'];
    $uploadedFile = $_FILES["Attachment"]["name"];
    $fileNames=explode('.',$uploadedFile);
    $newFileName="dummy.txt";
    do{
        $random = rand();
        $newFileName=$fileNames[0].$random.'.'.$fileNames[1];
    }while(file_exists("uploads/".$newFileName));

    $sql = "INSERT into fileuploads(teamId, filename, description, taskId) VALUES ('$team

    $res = mysql_query($sql);
    copy($_FILES['Attachment']['tmp_name'],'uploads/'.$newFileName);
    if($res>0){
    //----redirect to taskupload
      header('Location: zstudTaskUpload_form.php?msg=File with name '. $newFileName.' s

    }
}
```

Figure 89: Codes for file uploads

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5.4.22 E5: Send/Receive Message

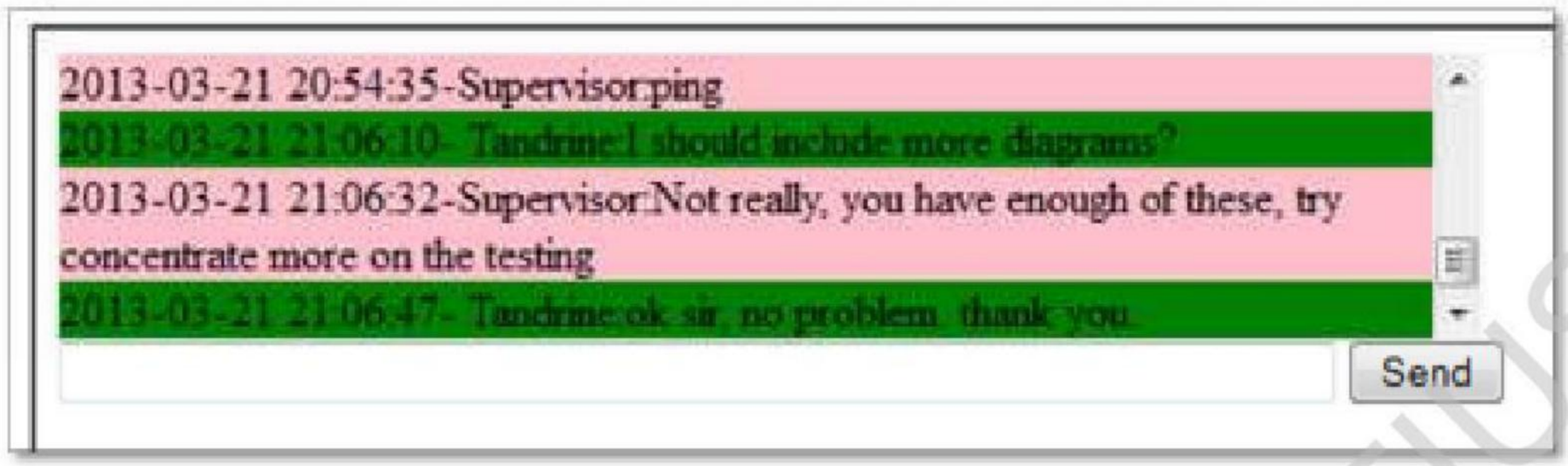

Figure 95: Interface to allow students and supervisor to send and receive messages

The messaging feature can be accessed through the student's home page for students and through the project's details for supervisors. Both use the same codes which include asynchronous requests to the server for making updates. The component is included on the main pages through an iframe which is refreshed at intervals of 30 seconds. However, this approach is suitable for a messaging system and not for a real-time chat system. The latter would require that a push-server be used to send updates to the clients as new chat messages are posted by others.

Each time a new sentence is sent (by pressing enter/clicking on send) a new *div* tag is added to a main-scrollbar enabled *div*.

Two issues faced were: The 'Enter' button from keyboard needed to be identified and secondly, the scrollbar should scroll to the bottom automatically to show the latest chat message. JavaScript functions have been written as shown below to take care of these situations.

```
function scrollDown(){
    var chat_div = document.getElementById('displaybox');
    chat_div.scrollTop = chat_div.scrollHeight;//codes to scroll
}
```

Figure 96: Function to scroll to display the latest message

```
function handleKeyPress(e){
    var key=e.keyCode || e.which;
    if (key==13){
        sendmsg();
        return false;
    }
}
```

Figure 97: Function to identify "Enter" key

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5.5 Difficulties Encountered During Implementation

At some point in time the database became corrupted during an SQL Injection Test (using the 'SQL Inject Me' Firefox Add-on) which 'successfully' managed to corrupt the entire database through the login form. The database was successfully restored from backups made at regular intervals throughout the implementation process. Appropriate counter measures were taken to mitigate SQL injection risks through proper form input sanitization.

Other implementation issues revolved around the lack of up-to-date documentation for some libraries and APIs such as the JPGraph and Google Calendar's API. However, through careful study of some existing examples made available by third parties in online forums, all the functionalities needed for the PSS were successfully implemented.

Based on a thoroughly prepared system design and a methodical approach to the implementation, no other major issues have been faced during that phase.

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5.4.18 E: Student's Home

The student's home page consists of hyperlinks to the following sub-sections:

- Search Projects (using the Web Service for Search described earlier)
- Send Progress Reports/View Progress Reports Reviews by supervisor
- View Gantt Chart
- Request Appointment

It also accommodates a chatting/messaging facility to enable students to communicate easily with their supervisor and keep track of past conversation (exchange of messages through the system).

5.4.19 E1: Send Progress Reports & E2: View Progress Reviews

Sending progress reports to supervisors is a crucial part in project monitoring and supervision since it is only through these reports that the supervisor can have concrete evidence that the project work is being undertaken appropriately. A form is provided for uploading files. Students browse for the document that they want to send to the supervisor and then choose the task for which this document has been written.

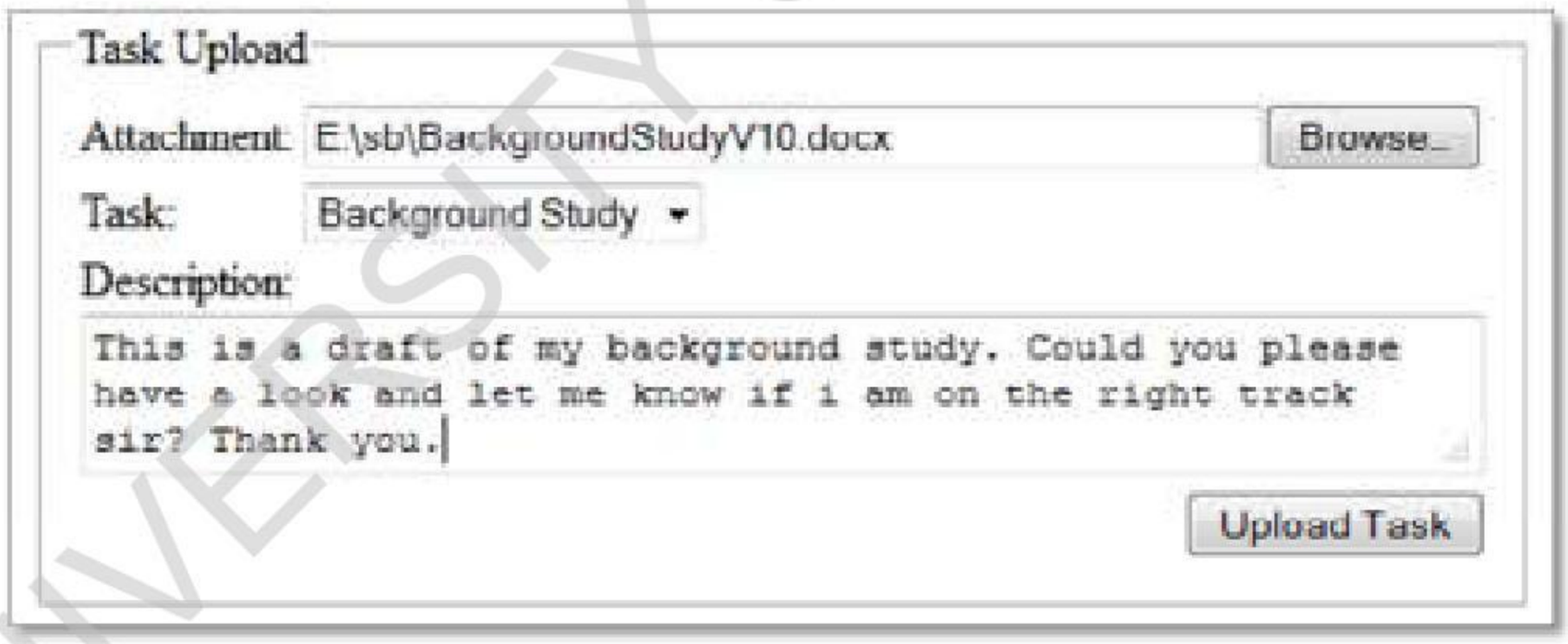

Figure 87: Interface to allow students to upload files under a given task

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6.1.2 Firefox and Google Chrome Developer Tools

Figure 99: Firefox Developer Tools

The Developer Tools in Chrome offers the Network panel which make it easier to see how the application uses the network. For instance, how long requests take and how much bandwidth is needed. It helps in speeding up page load times which is particularly useful with JpGraph since it makes use of the built-in cache system to send back a previously generated image. The cache system reduces the burden of the server by avoiding running all the codes following the initial `Graph()` call by checking if the image has already been generated and directly return it to the browser.

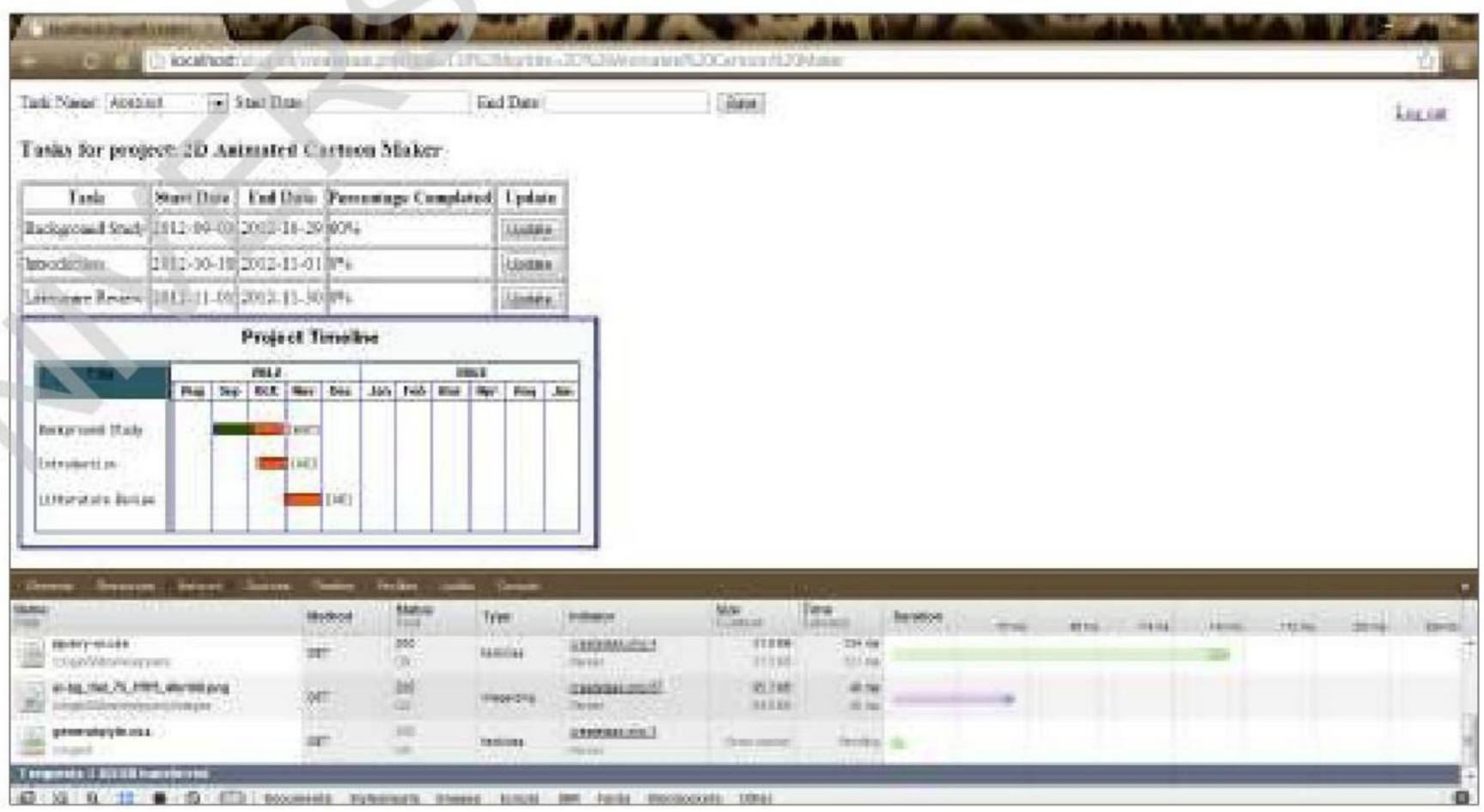

Figure 100: Google Chrome Developer Tools

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Before a file is copied to the 'uploads' folder, it is renamed, and the new name's existence is checked in the folder. After a non-already-existent name is found, the details of the files are inserted into the database which is ultimately displayed on the webpage as shown in Figure 90 which includes a download link and comments made by the supervisor if any.

File	Link	Description	Task	Date&Time Uploaded	Supervisor's Reviews	
BackgroundStudy/V104104.docx	Download	This is a draft of my background study. Could you please have a look and let me know if I am on the right track sir? Thank you.	Background Study	2013-03-19 21:08:31	Comment	Date/Time

Figure 90: Download link to download files for a task

Task	Date&Time Uploaded	Supervisor's Reviews	
		Comment	Date/Time
Background Study	2013-03-19 21:08:31	Dear Student, I had a look. The background seems fine so far. You should consider different technologies available and document them as well.	2013-03-19 21:14:29
		I forgot to mention, we need to meet and discuss some other ideas. Send me an appointment request for next week.	2013-03-19 21:15:50

Figure 91: Comments from supervisor for a task

5.4.20 E3: View Gantt Chart

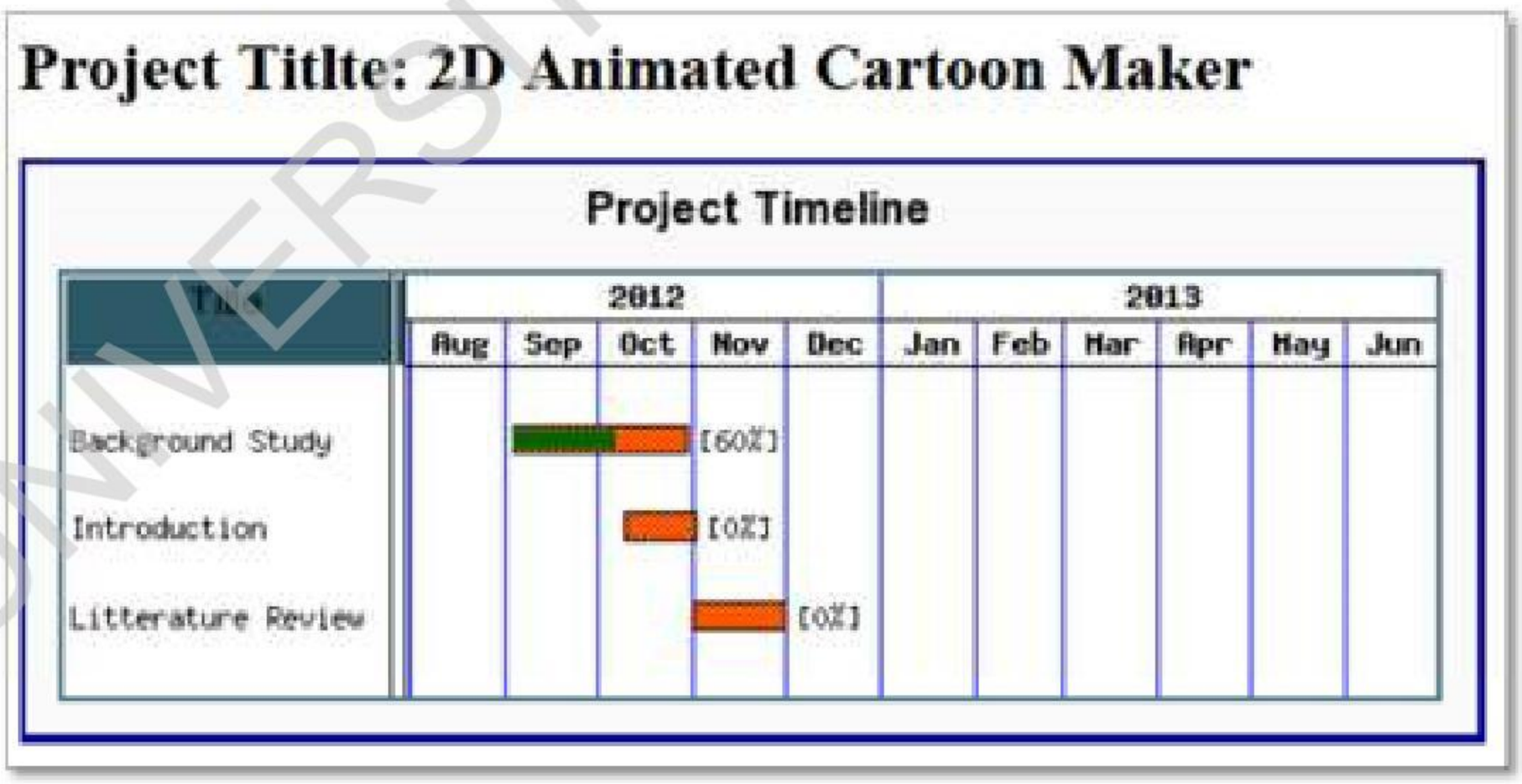

Figure 92: Updated Gantt chart for his project can be viewed by student

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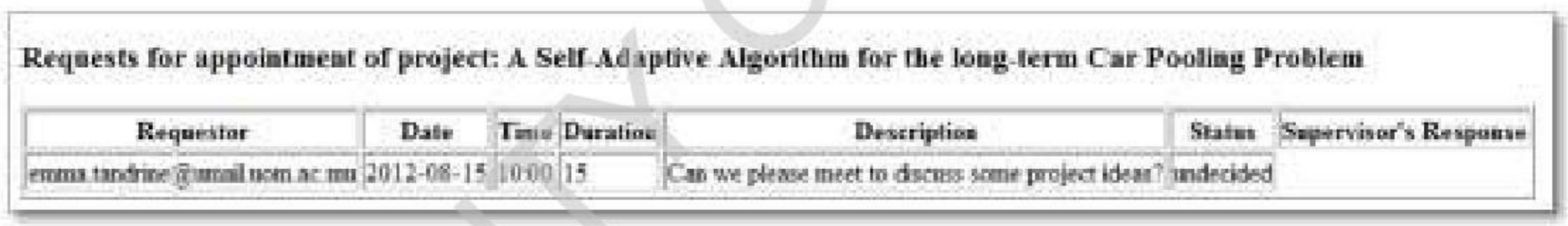
Generated using the JPGraph library (same as for D4), the picture is drawn by retrieving relevant details from the 'gantt' table given a *project id*. Students can only view the Gantt chart without making any changes.

5.4.21 E4: Request Appointment

A form as shown in Figure 93 is provided to allow students to make appointment requests. A Datepicker is used for the date. When a request is sent, it appears underneath on the same page and its status is 'undecided' and remains so until it is changed by the supervisor. Any response from the supervisor can also be read.

Figure 93: Interface to allow students to send appointment request



Requests for appointment of project: A Self-Adaptive Algorithm for the long-term Car Pooling Problem

Requestor	Date	Time	Duration	Description	Status	Supervisor's Response
emma.tandrine@umail.uom.ac.mu	2012-08-15	10:00	15	Can we please meet to discuss some project ideas?	undecided	

Figure 94: The request is displayed along with its status and the supervisor's response, if any

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Administrator – View Allocated Projects				
No.	**Test Case Description**	**Expected Result**	**Actual Result**	**Outcome**
1	Click on "View Allocated Projects" and check if the appropriate page is displayed.	A list of all courses should be displayed.	A list of all courses is indeed displayed.	Valid
2	Click on "E320 BSc (Hons) Software Engineering" and check if there are projects listed.	No project should be displayed.	No project is displayed.	Valid
3	Click on "E319 BSc (Hons) Applied Computing" and check if there are projects listed.	No project should be displayed.	No project is displayed.	Valid
4	Click on "E318 BSc (Hons) Computer Science" and check if there are projects listed.	A list of all allocated projects should be displayed.	A list of all allocated projects is displayed.	Valid
5	Click on "E311 BSc (Hons) Information Systems" and check if there are projects listed.	A list of all allocated projects should be displayed.	A list of all allocated projects is displayed.	Valid
6	Click on "E317 BSc (Hons) Computer Applications" and check if there are projects listed.	A list of all allocated projects should be displayed.	No list of projects is displayed.	Invalid – No allocation for the course had been made yet.

Table 18: Test Cases – View Allocated Projects

Administrator – Manage Project Coordinators				
No.	**Test Case Description**	**Expected Result**	**Actual Result**	**Outcome**
1	Click on combobox course and check if it is populated with the courses on offer.	Combobox should be populated with all courses on offer.	Combobox is populated with all courses on offer	Valid
2	Email (UoM) for project	Error message	No error message	Invalid – bug

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	coordinator left blank, course selected and "Add Person" clicked.	"Email cannot be blank" should be displayed and project coordinator not added.	is displayed for blank field; a row is added for project coordinator without any username.	in javascript.
3	Email (UoM) for project coordinator entered, course selected and "Add Person" clicked.	Project coordinator should be added and email containing temporary password should be sent.	Project coordinator is added and email containing temporary password is sent.	Valid
4	Button "Delete" clicked.	User should be alerted with error message "Are you sure you want to delete project coordinator?" and user should be able to confirm the deletion.	User is alerted with error message "Are you sure you want to delete project coordinator?" and user is able to confirm the deletion.	Valid
5	Check if user is informed after deletion.	A message should be displayed to inform the user about successful deletion of project coordinator.	A message is displayed to inform the user about successful deletion of project coordinator.	Valid
6	Button "Reset Password" clicked.	User should be alerted with error message "Are you sure you want to reset password for project coordinator?" and user should be able to confirm the	User is alerted with error message "Are you sure you want to reset password for project coordinator?" and user is able to confirm the	Valid

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		update.	update.	

Table 19: Test Cases – Manage Project Coordinators

Administrator – Reset Database				
No.	**Test Case Description**	**Expected Result**	**Actual Result**	**Outcome**
1	Click on "Clear" for Clear All Appointments	User should be alerted and should be able to confirm.	User is alerted and is able to confirm.	Valid
2	Click on "Clear" for Clear All Tasks	User should be alerted and should be able to confirm.	User is alerted and is able to confirm.	Valid
3	Click on "Clear" for Clear All Project Allocations	User should be alerted and should be able to confirm.	User is alerted and is able to confirm.	Valid
4	Click on "Clear" for Clear All File Uploads	User should be alerted and should be able to confirm.	User is alerted and is able to confirm.	Valid
5	Click on "Clear" for Clear All Reviews	User should be alerted and should be able to confirm.	User is alerted and is able to confirm.	Valid
6	Click on "Clear" for Reset The WHOLE DATABASE	User should be alerted and should be be able to confirm.	User is alerted and is able to confirm.	Valid

Table 20: Test Cases – Reset Database by Administrator

Administrator – Set/Modify Current Academic Year				
No.	**Test Case Description**	**Expected Result**	**Actual Result**	**Outcome**
1	Click on combobox and check if it is populated with academic years.	Combobox should be populated with academic years.	Combobox is populated with academic years.	Valid
2	Click on "Modify Current Year" to change the academic year for project allocation and supervision.	Texbox for "Current Academic Year" should be updated accordingly.	Textbox is updated accordingly to reflect the chosen academic year.	Valid

Table 21: Test Cases - Set/ Modify Current Academic Year by Administrator

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Project Coordinator – Allocate/De-allocate Projects				
No.	**Test Case Description**	**Expected Result**	**Actual Result**	**Outcome**
1	Click on combobox and check if it is populated with projects for the particular course.	Combobox should be populated with projects listed for the particular course.	Combobox is populated with projects listed for the particular course.	Valid
2	Click on combobox and check if it is populated with student names following the particular course.	Combobox should be populated with students following the particular course.	Combobox is populated with students following the particular course.	Valid
3	Click on combobox and check if it is populated with unallocated student names following the particular course	Combobox should contain only a list of students that have not been allocated any project.	Combobox contains a list of students that have not been allocated any project yet.	Valid
4	Click on "Allocate" to allocate selected project to selected students.	A message should be displayed to inform the user that the allocation is successful or not.	A message is displayed to inform the user that the allocation is successful or not.	Valid
5	Click on a "BSc (Hons) Computer Science" to view allocated projects for the batch	A list of all allocated projects for "BSc (Hons) Computer Science" should be displayed.	A list of all allocated projects for "BSc (Hons) Computer Science" is displayed.	Valid
6	Button "De-allocate" is clicked.	The user should be alerted and upon confirmation, the project should be de-allocated and the details	The user is alerted and upon confirmation, the project is de-allocated and the details cleared.	Valid

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		cleared.		

Table 22: Test Cases – Allocate/De-allocate Projects by Project Coordinator

Project Coordinator – View Allocated Projects				
No.	**Test Case Description**	**Expected Result**	**Actual Result**	**Outcome**
1	Click on "View Allocated Projects" and check if the appropriate page is displayed.	A list of all courses should be displayed.	A list of all courses is indeed displayed.	Valid
2	Click on "E320 BSc (Hons) Software Engineering" and check if there are projects listed.	No project should be displayed.	No project is displayed.	Valid
3	Click on "E319 BSc (Hons) Applied Computing" and check if there are projects listed.	No project should be displayed.	No project is displayed.	Valid
4	Click on "E318 BSc (Hons) Computer Science" and check if there are projects listed.	A list of all allocated projects should be displayed.	A list of all allocated projects is displayed.	Valid
5	Click on "E311 BSc (Hons) Information Systems" and check if there are projects listed.	A list of all allocated projects should be displayed.	A list of all allocated projects is displayed.	Valid
6	Click on "E317 BSc (Hons) Computer Applications" and check if there are projects listed.	A list of all allocated projects should be displayed.	No list of projects is displayed.	Invalid – No allocation for the course had been made yet.

Table 23: Test Cases – View Allocated Projects

Project Coordinator – Manage Supervisors				
No.	**Test Case Description**	**Expected Result**	**Actual Result**	**Outcome**
1	Email (UoM) for supervisor	Error message	No error	Invalid – bug

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	left blank, course selected and "Add Person" clicked.	"Email cannot be blank" should be displayed and supervisor not added.	message is displayed for blank field; a row is added for supervisor without any username.	in JavaScript.
2	Email (UoM) for supervisor entered, course selected and "Add Person" clicked.	Supervisor should be added and email containing temporary password sent.	Supervisor is added and email containing temporary password is sent.	Valid
3	Button "Delete" clicked.	User should be alerted with error message "Are you sure you want to delete supervisor?" and user should be able to confirm the deletion.	User is alerted with error message "Are you sure you want to delete supervisor?" and user is able to confirm the deletion.	Valid
4	Check if user is informed after deletion.	A message should be displayed to inform the user about successful deletion of supervisor account.	A message is displayed to inform the user about successful deletion of supervisor account.	Valid
5	Button "Reset Password" clicked.	User should be alerted with error message "Are you sure you want to reset password for supervisor?" and user should be able to confirm the update.	User is alerted with error message "Are you sure you want to reset password for supervisor?" and user is able to confirm the update.	Valid

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Table 24: Test Cases – Manage Supervisors Accounts by Project Coordinator

Supervisor – Propose New Projects				
No.	**Test Case Description**	**Expected Result**	**Actual Result**	**Outcome**
1	Check if project is added when "Title" is left blank.	User should be informed about blank title for project and project should not be added.	User is not informed about title being left blank and project is added for the selected course.	Invalid – No error message to cater for blank title yet.
2	Click on combobox and check if it is populated with all courses on offer.	Combobox should be populated with all courses on offer.	Combobox is populated with all courses on offer.	Valid
3	Click on "Add" and check if project is added for the selected course.	Project details should be added for the selected course.	Project details are added for the selected course.	Valid

Table 25: Test Cases – Propose New Projects

Supervisor – Manage Timetable/Appointments				
No.	**Test Case Description**	**Expected Result**	**Actual Result**	**Outcome**
1	Check that a request from student exists.	Request should be displayed.	Request is displayed.	Valid
2	Check if appointment is added to calendar after approval.	Appointment should be added to the supervisor's calendar and student should be notified.	Appointment is added to the supervisor's calendar and student is notified.	Valid
3	Check if appointment is added to calendar if request is rejected.	Appointment should not be added to the supervisor's calendar and student should be notified.	Appointment is not added to the supervisor's calendar and student is notified.	Valid

Table 26: Test Cases – Manage Timetable/Appointments by Supervisor

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		an end date.	supervisor choose an end date.	
4	Click on "Save" and check if task is added.	Task should be added and displayed.	Task is added and displayed.	Valid
5	Click on "Update" and check if Start Date, End Date and Percentage Completed can be edited.	Start Date, End Date and Percentage Completed should be editable.	Start Date, End Date and Percentage Completed are editable.	Valid
6	Enter a date range beyond the scale of the timeline.	The activity bar for the task should not be plotted.	The activity bar for the task is not plotted.	Valid

Table 28: Test Cases – Set Tasks and Milestones by Supervisors

Supervisor – Manage Progress				
No.	**Test Case Description**	**Expected Result**	**Actual Result**	**Outcome**
1	Click on "Update" and check if textboxes for Percentage Completed is enabled and editable.	Percentage Completed should be enabled and editable.	Percentage Completed is enabled and editable.	Valid
2	Enter value for Percentage Completed and Click on "Save".	The supervisor should be alerted and upon confirmation the value should be reflected on the activity bar.	The supervisor is alerted and the value is reflected on the activity bar upon confirmation.	Valid

Table 29: Test Cases – Manage Progress by Supervisors

Student – Send Progress Reports				
No.	**Test Case Description**	**Expected Result**	**Actual Result**	**Outcome**
1	Click on "Browse" and check if File Upload box appears.	File Upload box should appear.	File Upload box appears.	Valid
2	Click on the combobox	The combobox	The	Valid

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	"Task" and check if it is populated with tasks already set by the supervisor.	should be populated with only tasks already set by the supervisor.	combobox is populated with only tasks already set by the supervisor.	
3	Click on "Upload Task" and check if the file is uploaded under the given task added.	The file should be uploaded under the given task and should be added.	The file is uploaded under the given task and is added.	Valid

Table 30: Test Cases - Send Progress Reports by Student

Student – View Progress Reviews				
No.	**Test Case Description**	**Expected Result**	**Actual Result**	**Outcome**
1	Check if supervisor has provided comments for the work.	Supervisor's comments for the particular task should be displayed.	Supervisor's comments for the particular task are displayed.	Valid

Table 31: Test Cases - View Progress Reviews

Student – View Gantt Chart				
No.	**Test Case Description**	**Expected Result**	**Actual Result**	**Outcome**
1	Check if Gantt chart is displayed.	Gantt chart should be displayed.	Gantt chart is displayed.	Valid

Table 32: Test Cases - View Gantt Chart

Student – Request Appointment				
No.	**Test Case Description**	**Expected Result**	**Actual Result**	**Outcome**
1	Click on "Date" and check if date picker appears.	Date picker should appear and let the student choose a date for the meeting.	Date picker is not displayed. Date has been entered manually.	Invalid – date picker missing.
2	Click on combobox "Starting Time" and check if	Combobox should be populated with	Combobox is populated with	Valid

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	it is populated with valid working hours.	valid working hours.	valid working hours.	
3	Click on combobox "Approximate Duration of Meeting" and check if it is populated with reasonable meeting durations.	Combobox should be populated with reasonable meeting durations.	Combobox is populated with reasonable meeting durations.	Valid
4	Click on "Send Appointment Request" and check if it is displayed with a default status of "undecided".	Meeting request should be sent to the supervisor and added to a list of requests for the project with a status of "undecided".	Meeting request is sent to the supervisor and added to a list of request with a default status of "undecided".	Valid
5	Check if the meeting is accepted and added to the supervisor's calendar.	Appointment should be added to the supervisor's calendar and the student should be notified.	Appointment is added to the supervisor's calendar and the student is notified.	Valid
6	Check if the meeting is rejected and not added to the supervisor's calendar.	Appointment should not be added to the supervisor's calendar and the student should be notified.	Appointment is not added to the supervisor's calendar and student is notified.	Valid

Table 33: Test Cases – Request Appointment by Student

Web Service – Search Projects				
No.	**Test Case Description**	**Expected Result**	**Actual Result**	**Outcome**
1	Enter search terms and select radio button "Project Title".	A list of projects containing the search keyword found in project titles should be displayed.	A list of projects containing the search keyword found in project titles is displayed.	Valid

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2	Enter search term less than 4 characters long.	A list of projects containing the search keyword should be displayed.	No list containing the search keyword is displayed.	Invalid- indexes should be reconfigured in MySQL.
3	Enter search terms and select radio button "Whole Project Description".	A list of projects containing the search keyword found in project information should be displayed.	A list of projects containing the search keyword found in project information is displayed.	Valid
4	Enter search terms and select radio button "Project Areas".	A list of projects containing the search keyword found in project areas should be displayed.	A list of projects containing the search keyword found in project areas is displayed.	Valid

Table 34: Test Cases – Web Service to search for projects

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CHAPTER 7 – EVALUATION

The project aimed at improving project supervision and enhancing the final year project experience by providing an online tool for the various stages of project development. The tool would assist supervisors in appropriate decision-making related to students' progress while keeping everyone informed and updated about final year project titles and ideas.

From the outset, a series of objectives complying with the requirements of such a system had been identified and have eventually been met. Evaluators involving 12 users, notably 10 students and 2 supervisors have been co-opted to provide feedback. The functionalities that have been evaluated are as follows:

1. *A web platform for supervisors to manage projects and students.*

Since it has been possible to obtain live-data about projects, the testing of the system has been mostly performed based on current information made available by the Computer Science and Engineering Department of the University of Mauritius.

There had been 205 final year project descriptions proposed by the academics of the CSE Department and have been categorized under three courses, namely, BSc (Hons.) Computer Science, BSc (Hons.) Information Systems and BSc (Hons.) Computer Applications. Additionally, two new courses, BSc (Hons.) Software Engineering and BSc (Hons) Applied Computing, being offered by the department have been considered by the system and have already been catered for.

2. *The application allows the submission of deliverables by students.*

PSS provides each group of project students with an interface to upload files under specific tasks. Only the tasks which have already been created by supervisors and for which uploads are allowed are visible to students. These tasks are previously set by supervisors and the latter is in turn able to download the files for review. This is mostly convenient in the sense that prior to the project supervision system, supervisors had to search their email inbox or among all the printed documents to find any work sent by project students and then provide feedback.

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3. *Project meeting schedules has been enhanced by setting up an appointment subsystem.*

Through a calendar, each supervisor can make available the free time slots at which he is disposed to see project students. Students can check which slots are already taken up before sending any request, thus resulting in no meeting clashes. Existing practices involve different groups of students asking to meet the supervisor at the same time and the latter has to decide whom to give priority to, especially when the submission date is near. However, with the use of the appointment subsystem embedded in PSS, such issues are less likely to crop up.

4. *Supervisors can provide feedback to students regarding the work submitted via the online platform.*

PSS provides supervisors and students with such flexibility that both parties need not forcibly meet for the project to progress. After students have uploaded their work, the supervisor can check the work whenever he has some free time. It also serves as a record for all that has been provided as feedback and the versions that have been uploaded by students. They can also instantly collaborate via the chat system provided by PSS. This process occurred differently till date and required that students and supervisors meet up or communicate via email.

5. *Information is presented graphically using charts to better understand basic figures.*

PSS allows each project to have a timeline which contains the tasks set by supervisors. When tasks have been checked, the supervisor can update the task progress which is reflected on the timeline. This way, both supervisors can communicate the percentage progress that has been achieved while students can better perceive the amount of work that has been completed and what remains to be done.

6. *A web service is available*

A web service is available to be used by anyone who wishes to know which projects have been proposed based on specific search terms and criteria. The idea is to provide stakeholders with timely and relevant information, and also it can be useful to know what is being proposed in specific areas. The most common way to know which projects had been done in past years is via the University of Mauritius Library which is equipped with a system that enables project search based on project titles. It is nonetheless lacking since not all past projects are listed and current projects are not yet recorded.

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Supervisor – Project Details				
No.	**Test Case Description**	**Expected Result**	**Actual Result**	**Outcome**
1	Click on "Manage" and check if there exist project details.	The supervisor should be able to see project details.	The supervisor is able to see project details.	Valid
2.	Check that a list of tasks for the project exists.	A list of tasks for the project should be displayed.	A list of tasks for the project is displayed.	Valid
3.	Click on "X" to remove a task comment.	The supervisor should be alerted and upon confirmation, the comment should be deleted.	The supervisor is alerted and the comment is deleted upon confirmation.	Valid
4.	Click on "Edit" to change a task comment.	The supervisor should be alerted and upon confirmation the comment should be updated.	The supervisor is alerted and the comment is updated upon confirmation.	Valid

Table 27: Test Cases – Project Details

Supervisor – Set Tasks and Milestones				
No.	**Test Case Description**	**Expected Result**	**Actual Result**	**Outcome**
1	Click on combobox "Task Name" and check if it is populated with the project tasks.	The combobox should be populated with the project tasks	The combobox is populated with the project tasks.	Valid
2	Click on "Start Date"textbox and check if date picker appears.	Date picker should appear and let the supervisor choose a start date.	Date picker appears and lets the supervisor choose a start date.	Valid
3	Click on "End Date"textbox and check if date picker appears.	Date picker should appear and let the supervisor choose	Date picker appears and lets the	Valid

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to facilitate students, academics and researchers to find out about projects in different areas and possibly enable sharing of ideas, proposal of follow-up projects and future collaboration to take place. The service can be easily integrated into other applications for other innovative usages and which its considerably large bank of project descriptions, can also be used as an experimental platform for students to try different search algorithms.

Since a supervisor is allocated several teams of students, it can be quite tedious to monitor their progress manually. Through PSS, this is greatly facilitated through the keeping of records with timestamps and the ability for the supervisor to write reviews which is stored in the system. At the end of the academic year, the records can be consulted to help in the project assessment.

Since it is widely accepted that an image tend to convey information faster and better than descriptive text, monitoring the progress of projects through diagrams, and in the case of PSS, Gantt Charts greatly helps in the monitoring.

8.2.2 Weaknesses

Despite all its strengths, due to time constraints, it has not been able to consider exceptional cases of project team splitting. However, PSS can overcome this weakness, since it allows for de-allocation of projects from teams who can then be re-assigned to projects individually. In addition, like most project management tools, PSS heavily relies on the judgment of the supervisors to determine the time that can be allocated for a particular task and also, the percentage of work completed for a particular task. Another weakness of PSS is its inability to notify users through PUSH-style notifications about events such as new message received, new review received and task milestone reached.

8.3 Difficulties Encountered During the Project

Several libraries and APIs (Such as JPGraph and Google Calendar) were not familiar to the author before working on this project and occasionally. This had an impact on the limited time available for the author to learn using them before implementing parts making use of same. Through perseverance, the author managed to sufficiently master these libraries and APIs for use in the project.

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8.4 Future Works and Directions

Although this project has met all its major objectives, there remain a number of desirable functionalities and enhancements that can potentially be looked into as future works. These were not taken on board mainly due to resource constraints such as limited time and reduced man power. These future works, categories into two groups, namely, 'Additional Desirable Functionalities' and 'Enhancement of Performance and Maintainability', are described below:

8.4.1 Additional Desirable Functionalities

Automating the Project Allocation process

The scope of this project focused on the project monitoring aspects. However, a simplified version of the project allocation process was implemented to be used by project coordinators for allocating projects to students in order to enable a full-fledged testing and evaluation of the other components of the system. Nevertheless, the allocation process implemented, merely mimicked the current manual method used for project allocation. Since there are a number of final year students who have been focusing on the Project Allocation Process, their parts could be integrated into this project (Project Supervision System) such that the allocation is done automatically based on the preferences of students and the research areas of potential project supervisors.

Partially automating the project marking process

Automated correction and marking is now well-established in cases of close-ended questions such as Multiple Choice Questions (MCQ) types, for which numerous software systems have already been developed, correction and marking of essay types (which applies in the case of Dissertation/ Final Year project reports) is still an active research area. Therefore, it is highly desirable to undertake further research into this aspect which can, for the very least, enable partial automated marking. As an easy step towards this, both Project Supervisors and Examiners can in the future be allowed to input marks for the project into the Project Supervision System (PSS) itself which is then accessible by Project Coordinators.

Integration of Plagiarism checking mechanisms

Plagiarism, especially for final year project reports has been a challenging issue to tackle by the university. Recently, the University of Mauritius has acquired licenses for 'Turnitin' to enable final year projects and other assignments to be checked for

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APPENDIX A – SAMPLE DOCUMENT (SPECIMEN PROJECT PROGRESS LOG)

RECORD OF STRATEGIC MEETINGS WITH SUPERVISOR

Meetings	Date	Topics/Themes Discussed	Comments (If any)	Supervisor's Initials	Student's Initials

Supervisor: …… Signature: …… Date: ……

N.B: Both the supervisor and the student should retain a copy of this Project Progress Log.
A copy of the duly filled and signed Progress Log should be **included and submitted in the section 'Appendices' of the Dissertation**.

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APPENDIX B – INTERVIEW QUESTIONS

Interview questions:

1. For each deliverable, are a set of instructions/guidelines provided to students prior to the start of the task?
2. How are learning outcomes after each milestone managed?
3. During the project, students read articles, research papers, books and online materials. How are learning references managed?
4. Are any missed deadlines recorded?
5. Are missed meetings recorded?
6. Is there any major problem faced till date?

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APPENDIX C – TEST RESULTS

Test Results

1. Correct username and password entered

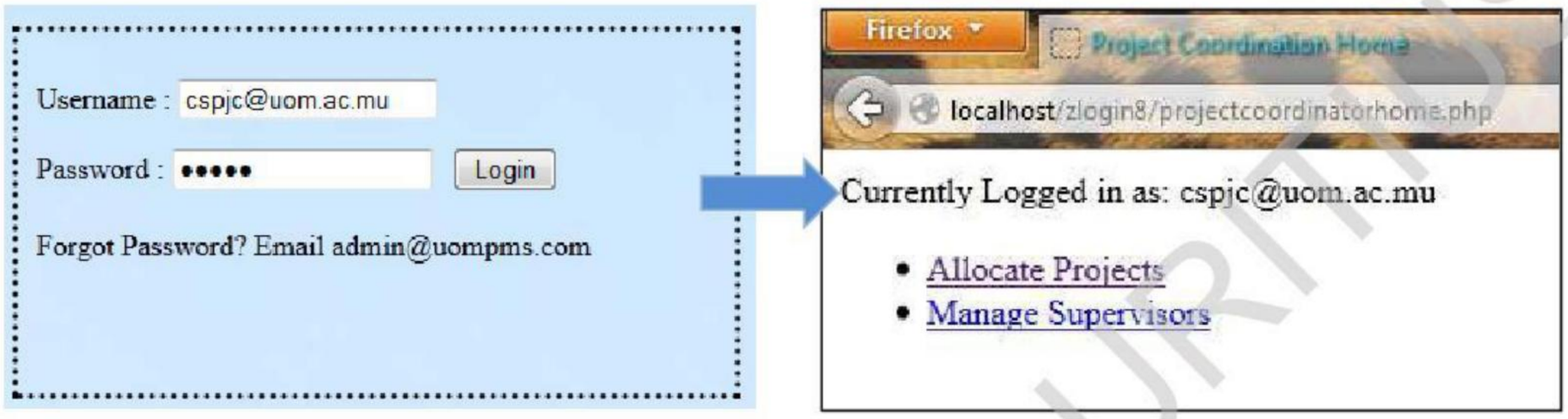

Figure 102: User is redirected to personal area based on credentials

2. Incorrect combination of username and password entered

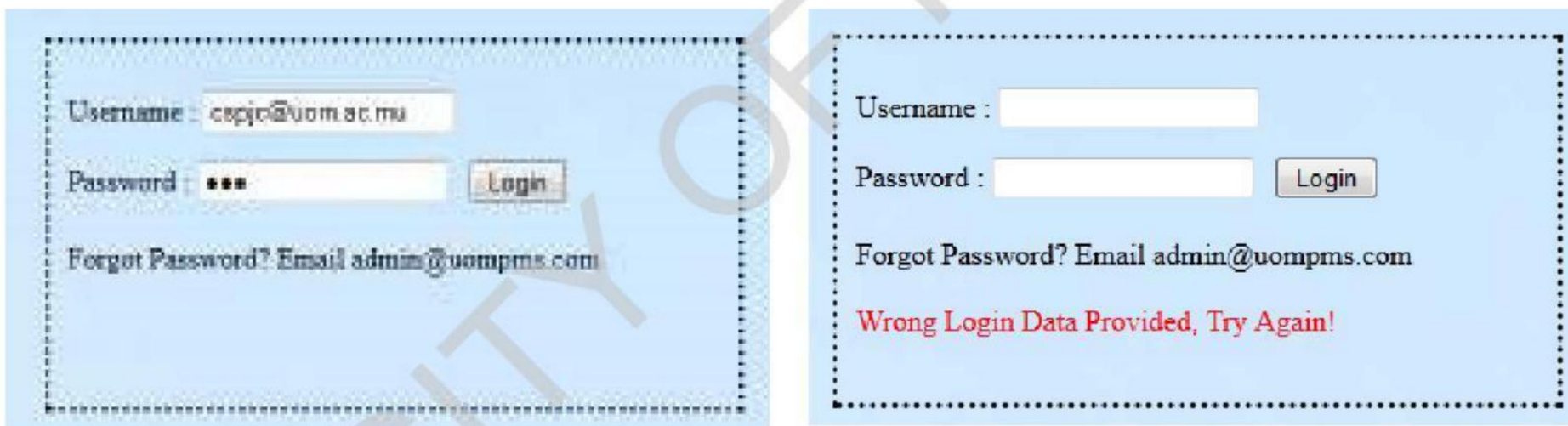

Figure 103: User is alerted with appropriate error message and prompted to login again

3. Username other than email address provided by university

Figure 104: User is alerted with the error message and prompted to login using correct username

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plagiarism automatically. Integration of Turnitin [40] into third party software system is possible, as evidenced by the Moodle [41] and Blackboard [42] E-Learning platforms. Unfortunately, this is not currently feasible for PSS due to the fact that there is another license, which is more costly that the University will have to buy in order for integration of Turnitin to be allowed. However, in the future, this can be negotiated with University management.

Integration of a 'Version Control' system to track changes and reviews in submitted documents

The current method that PSS utilizes for enabling students to submit reports allow for multiple files to be submitted which is marked by a timestamp. Supervisors can then add comments each submission. Enabling students to work on different versions of the same file instead can be possible if a Version Control System is implemented in the future. Such systems exist already as open source and can therefore be integrated into PSS. This will allow for different versions to be compared easily.

8.4.2 Enhancement Performance and Maintainability

Further optimization of SQL Queries

PSS makes extensive use of MySQL Database Management System to manage its data. Therefore, SQL queries have been used to insert, update and delete data in the database. Due to time constraints and lack of expertise, there has been limited effort to optimize SQL queries. In the future, this can be looked into and will further enhance the system's performance.

Use of Object Oriented System Development Methodology

One of the reasons for the use of PHP as the main server-side scripting language for PSS is the possibility to adopt an Object Oriented approach. Therefore, as a future enhancement, Object Oriented System Development can be used for the system. This will result in code re-use and improve the system's maintainability.

Large scale evaluation

Due to the limited time available, PSS could be evaluated with only few users (10 students, 2 lecturers). In the future, large scale evaluation can be performed whereby around 50 students and 10 lecturers can be requested to use the system concurrently. This will evaluate the system's performance and scalability in a real-life situation.

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7. Button “Delete” is clicked.

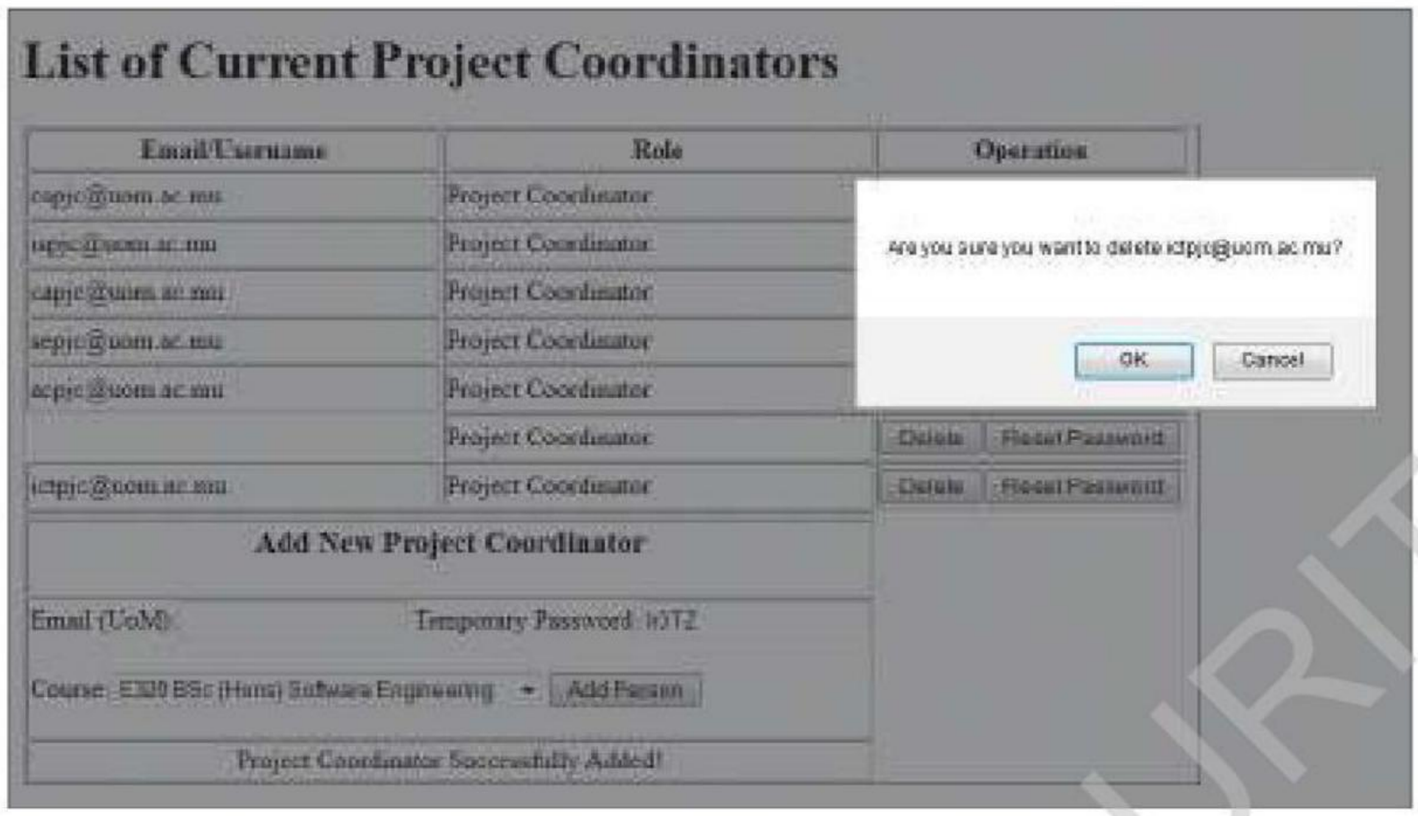

Figure 108: User is alerted with error message and is able to confirm the deletion.

8. Check if user is informed after deletion.

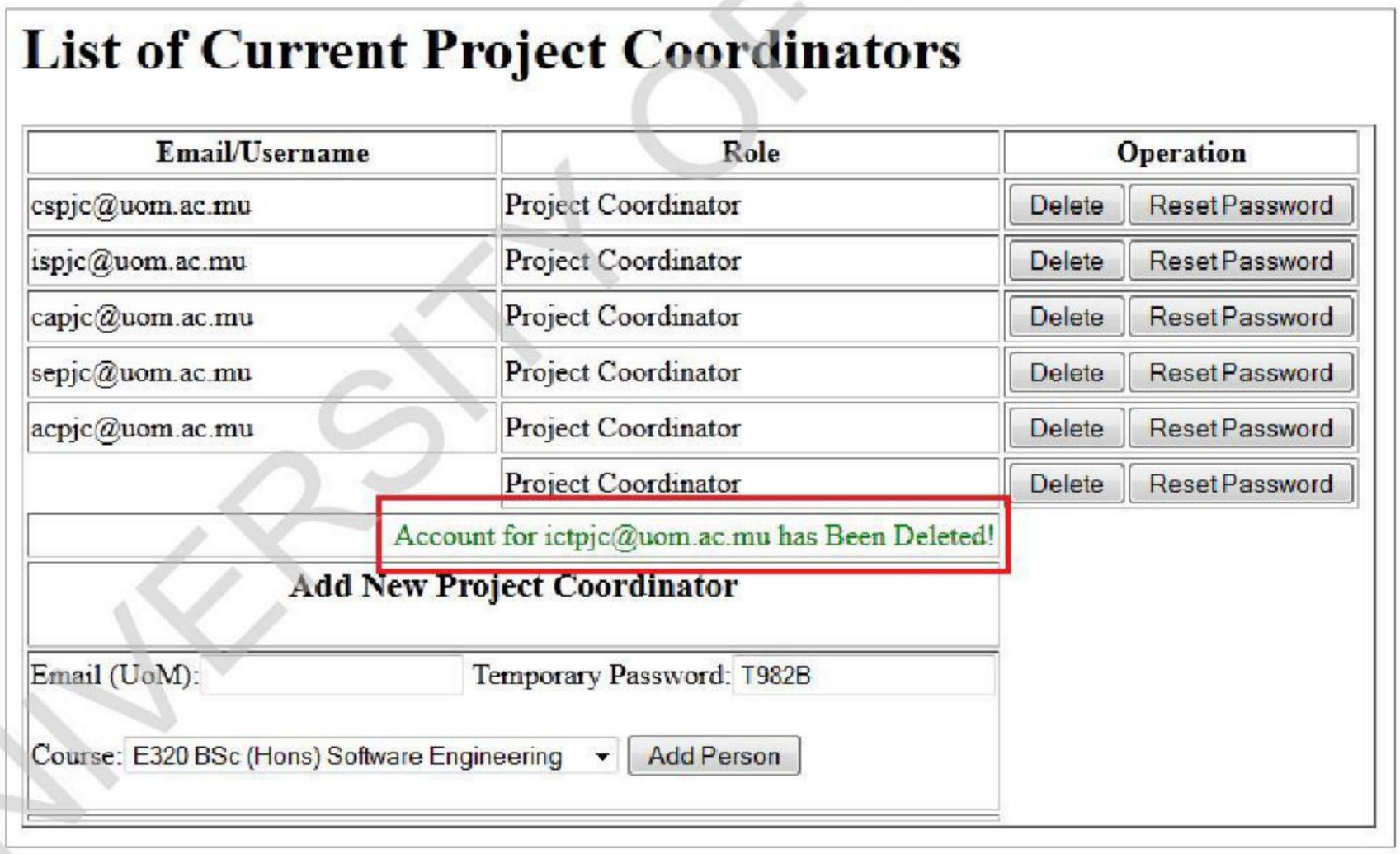

Figure 109: A message is displayed to inform the user about successful deletion.

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9. Button “Reset Password” is clicked.

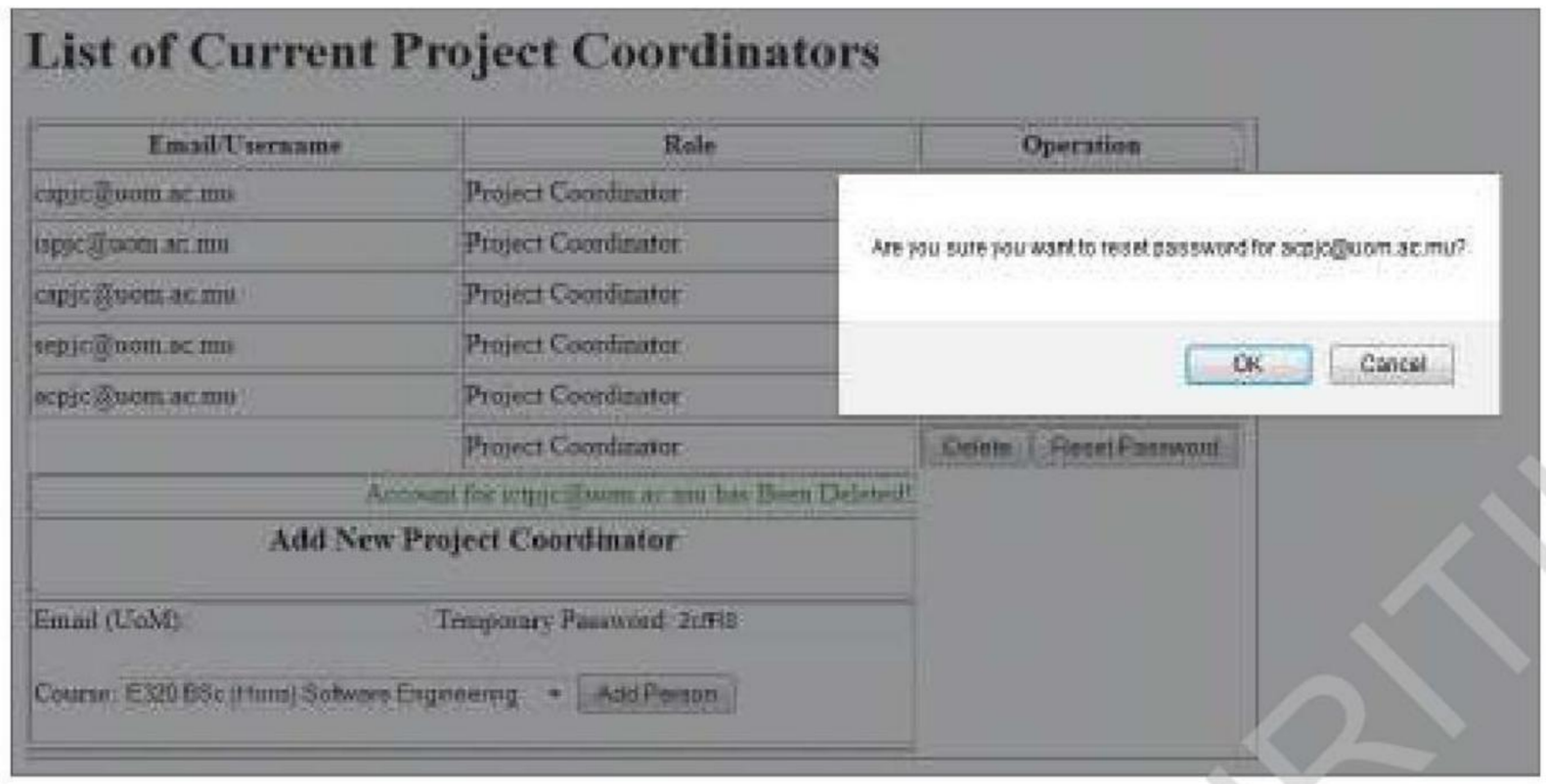

Figure 110: User is alerted with error message and is able to confirm the update.

10. Click on “Clear” for Clear All Appointments. (The same is repeated for all clearing)

Figure 111: User is alerted and is able to confirm.

11. Click on combobox and check if it is populated with academic years.

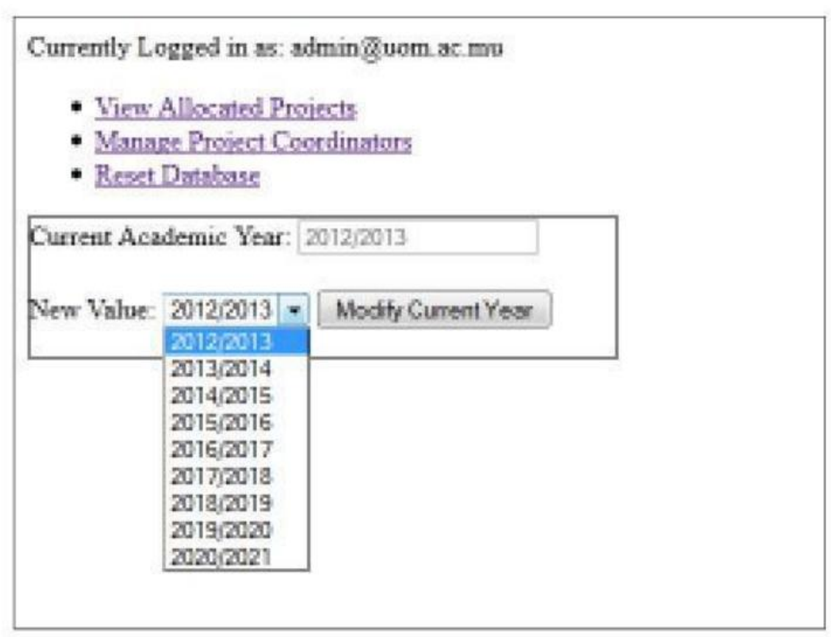

Figure 112: Combobox is populated with academic years.

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12. Click on "Modify Current Year" to change the academic year for project allocation and supervision.

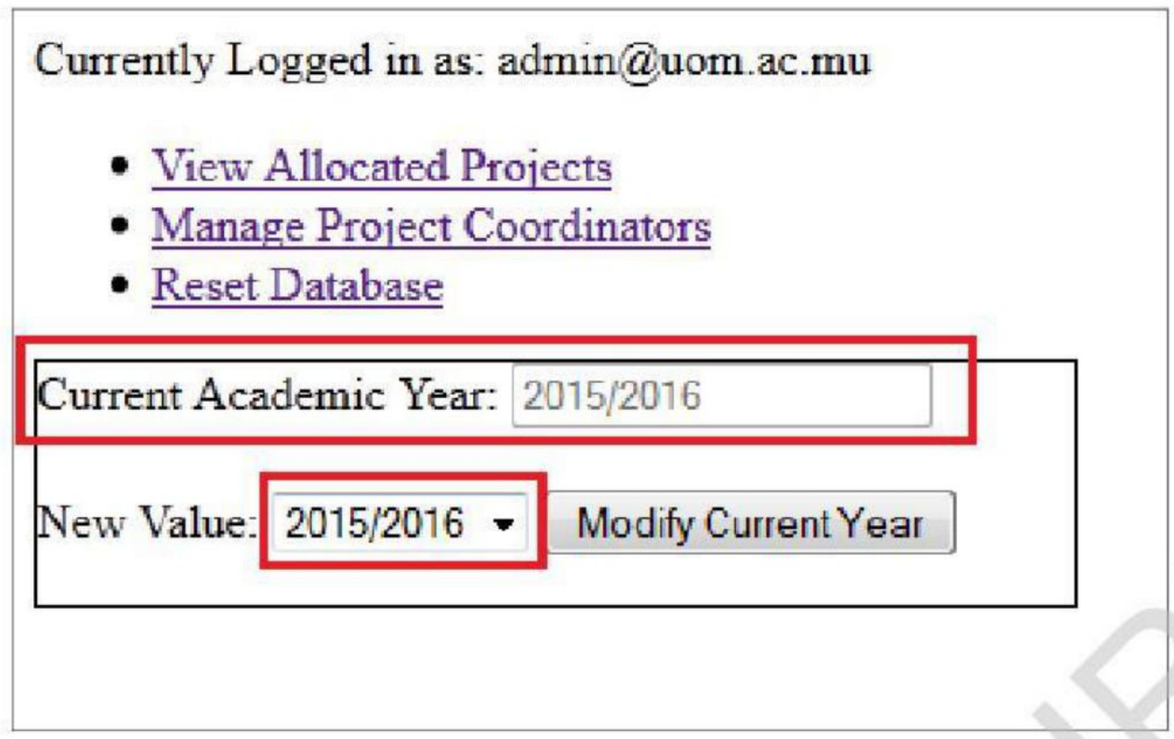

Figure 113: Textbox is updated accordingly to reflect the chosen academic year.

13. Click on combobox and check if it is populated with projects for the particular course.

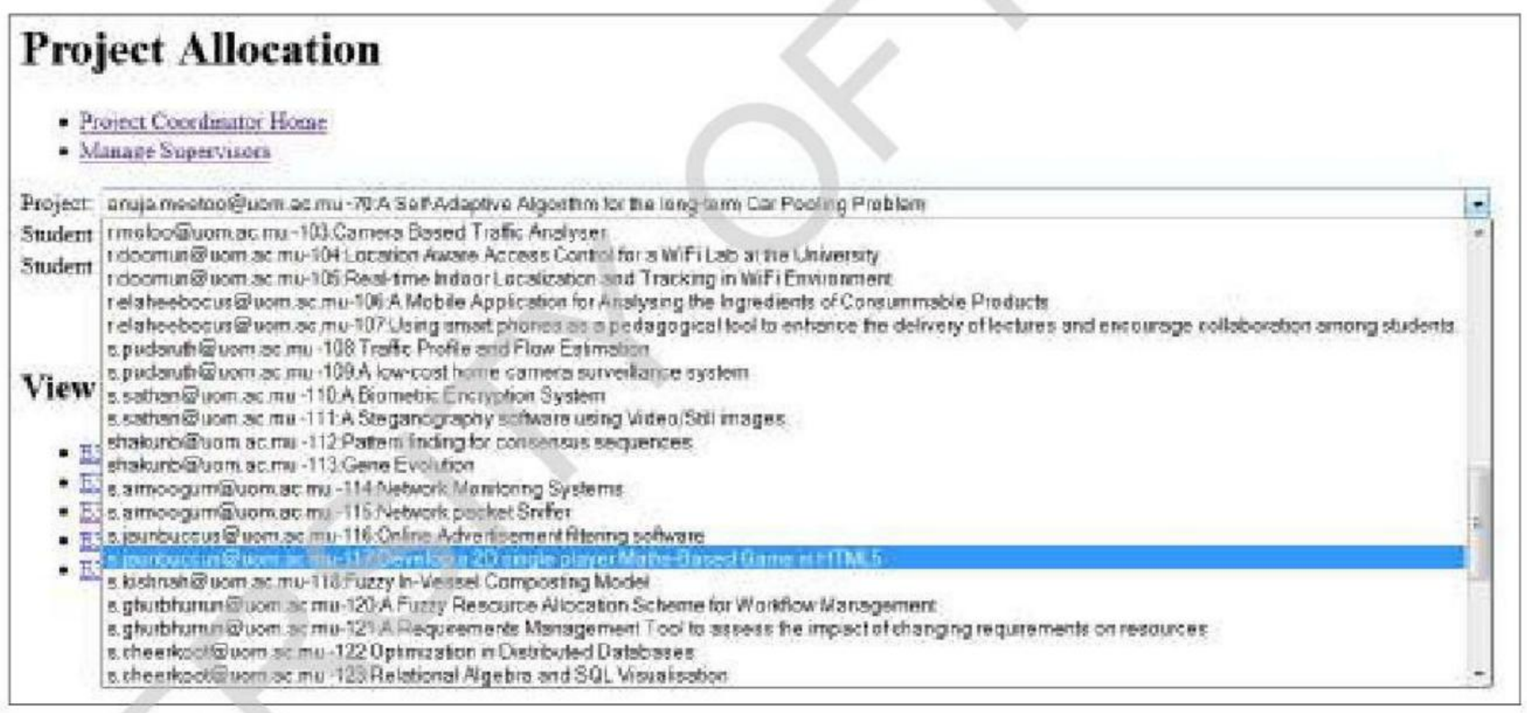

Figure 114: Combobox is populated with projects listed for the particular course.

14. Click on a "BSc (Hons) Computer Science" to view allocated projects for the batch.

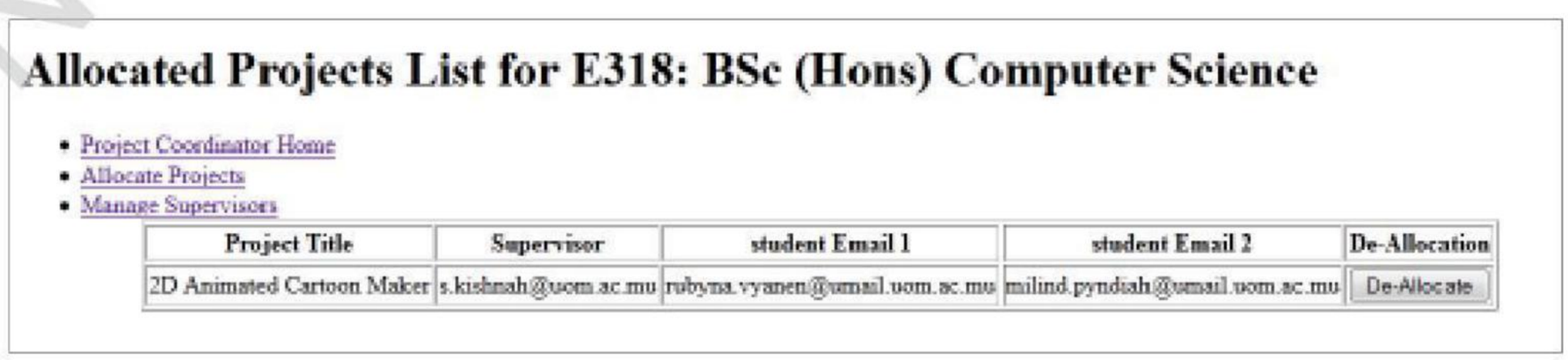

Figure 115: A list of all allocated projects for "BSc (Hons) Computer Science" is displayed.

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15. Button “De-allocate” is clicked.

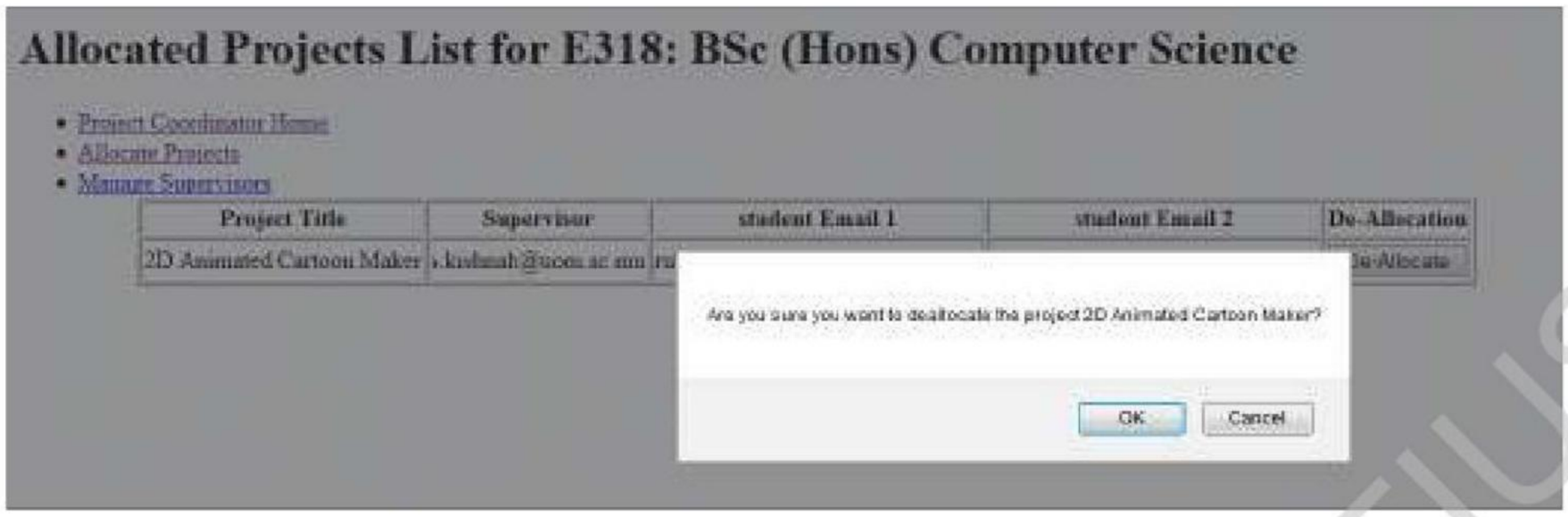

Figure 116: The user is alerted and upon confirmation, the project is de-allocated and details cleared.

16. Email (UoM) for supervisor left blank, course selected and “Add Person” clicked.

Figure 117: No error message is displayed for blank field; a row is added for supervisor without any username.

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17. Email (UoM) for supervisor entered, course selected and "Add Person" clicked.

Figure 118: Supervisor is added and email containing temporary password is sent.

18. Button "Delete" clicked.

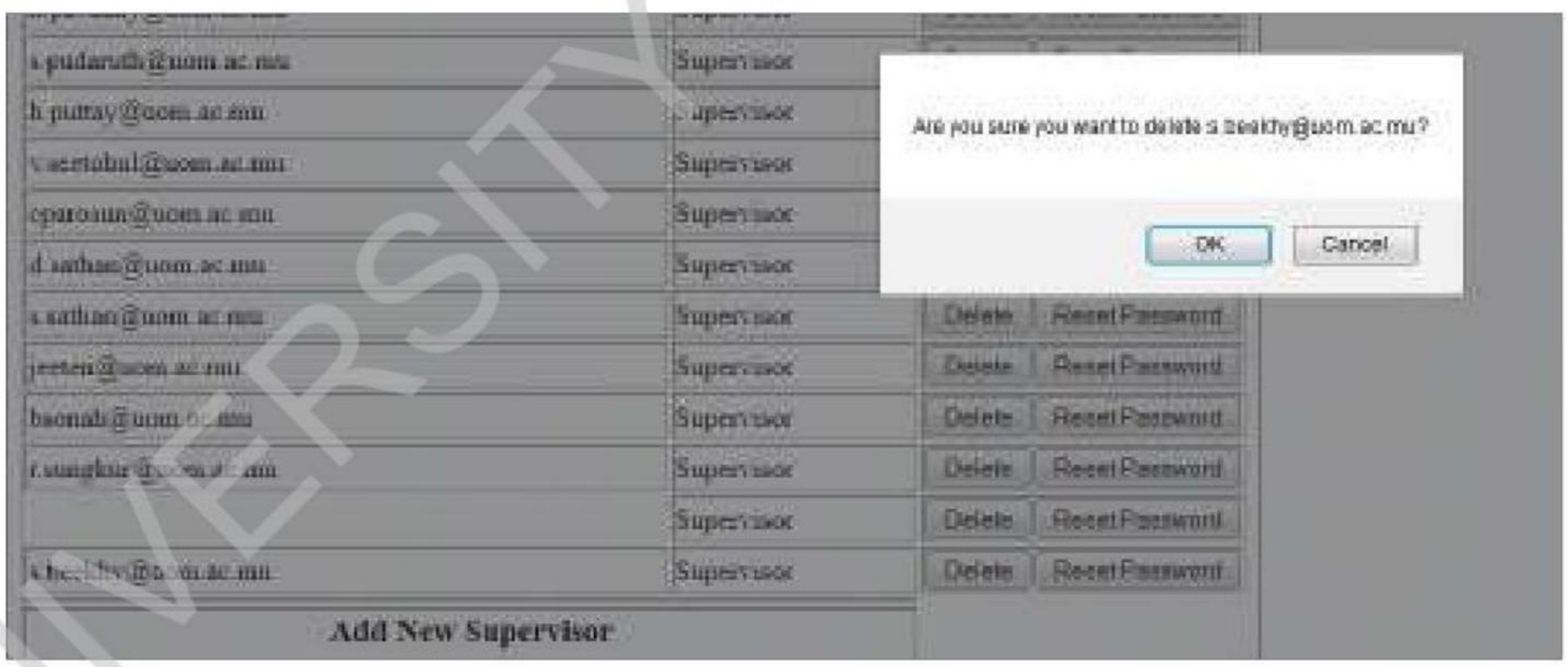

Figure 119: User is alerted with error message and is able to confirm the deletion.

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19. Check if user is informed after deletion.

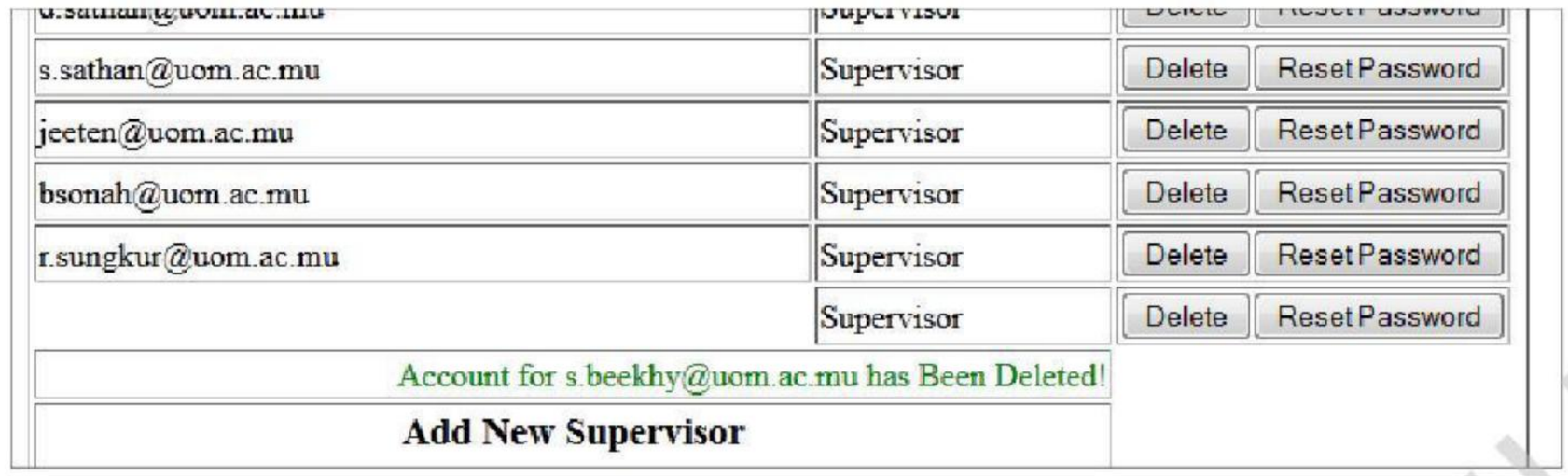

Figure 120: A message is displayed to inform the user about successful deletion of supervisor account.

20. Button "Reset Password" clicked.

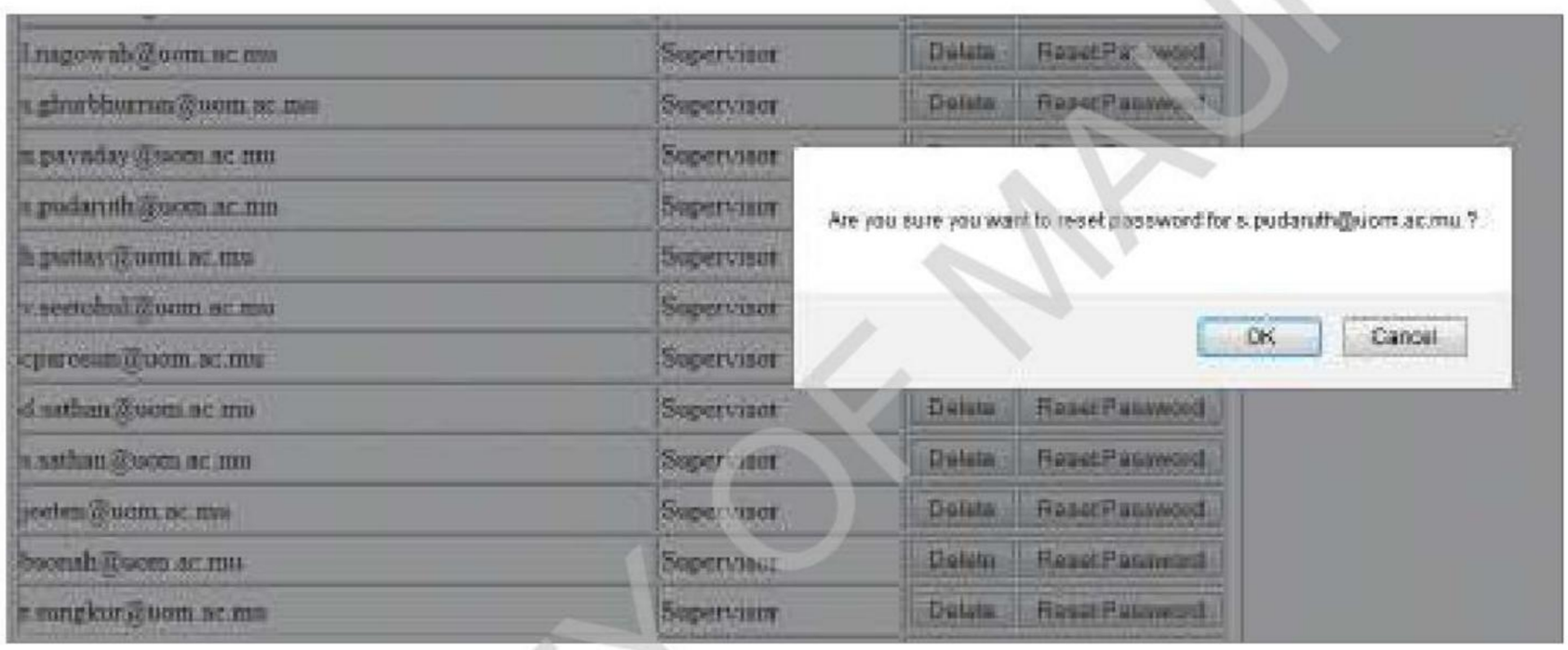

Figure 121: User is alerted with error message and is able to confirm the update.

21. Check if project is added when "Title" is left blank.

Figure 122: User is not informed about title being left blank and project is added for the selected course.

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22. Click on combobox and check if it is populated with all courses on offer.

Figure 123: Combobox is populated with all courses on offer.

23. Click on "Add" and check if project is added for the selected course.

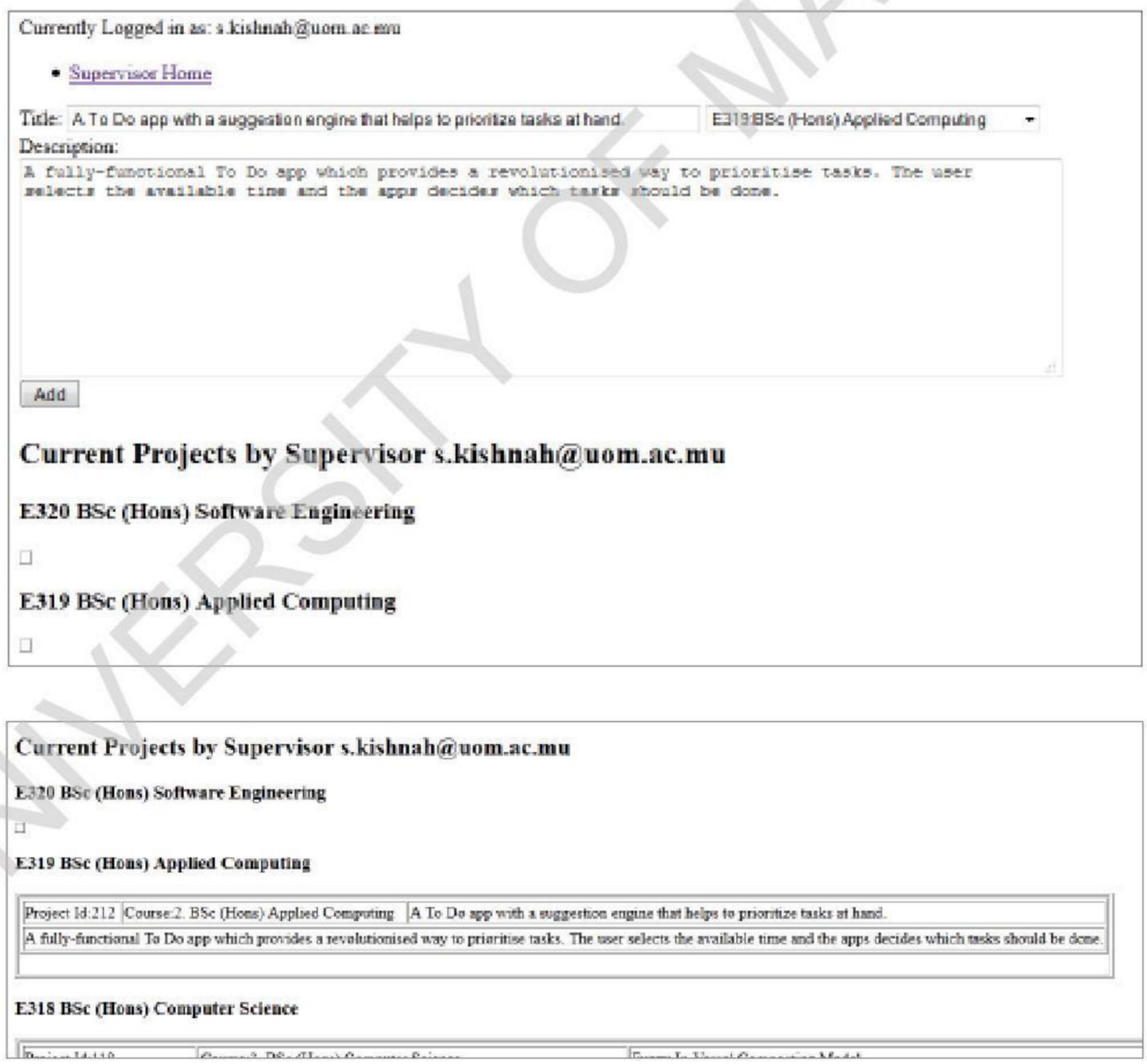

Figure 124: Project details are added for the selected course.

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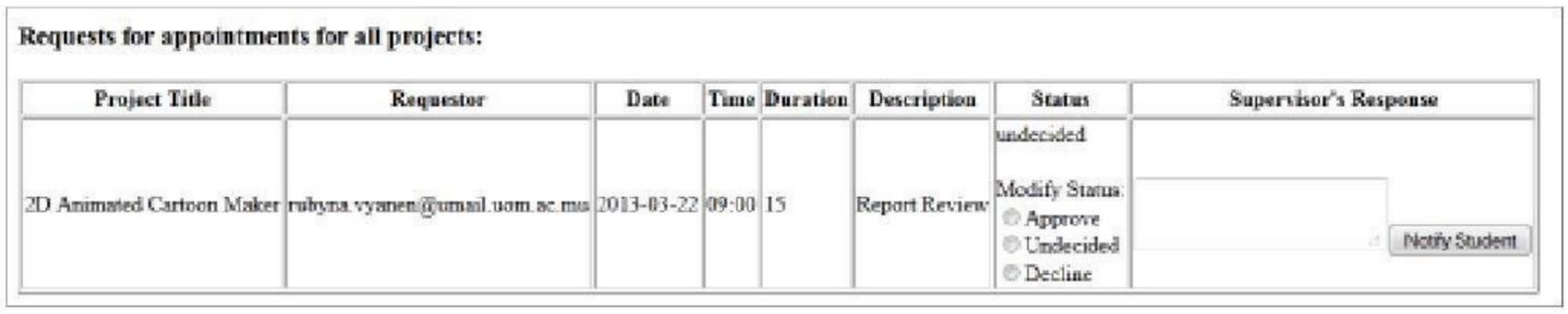
24. Check that a request from student exists.

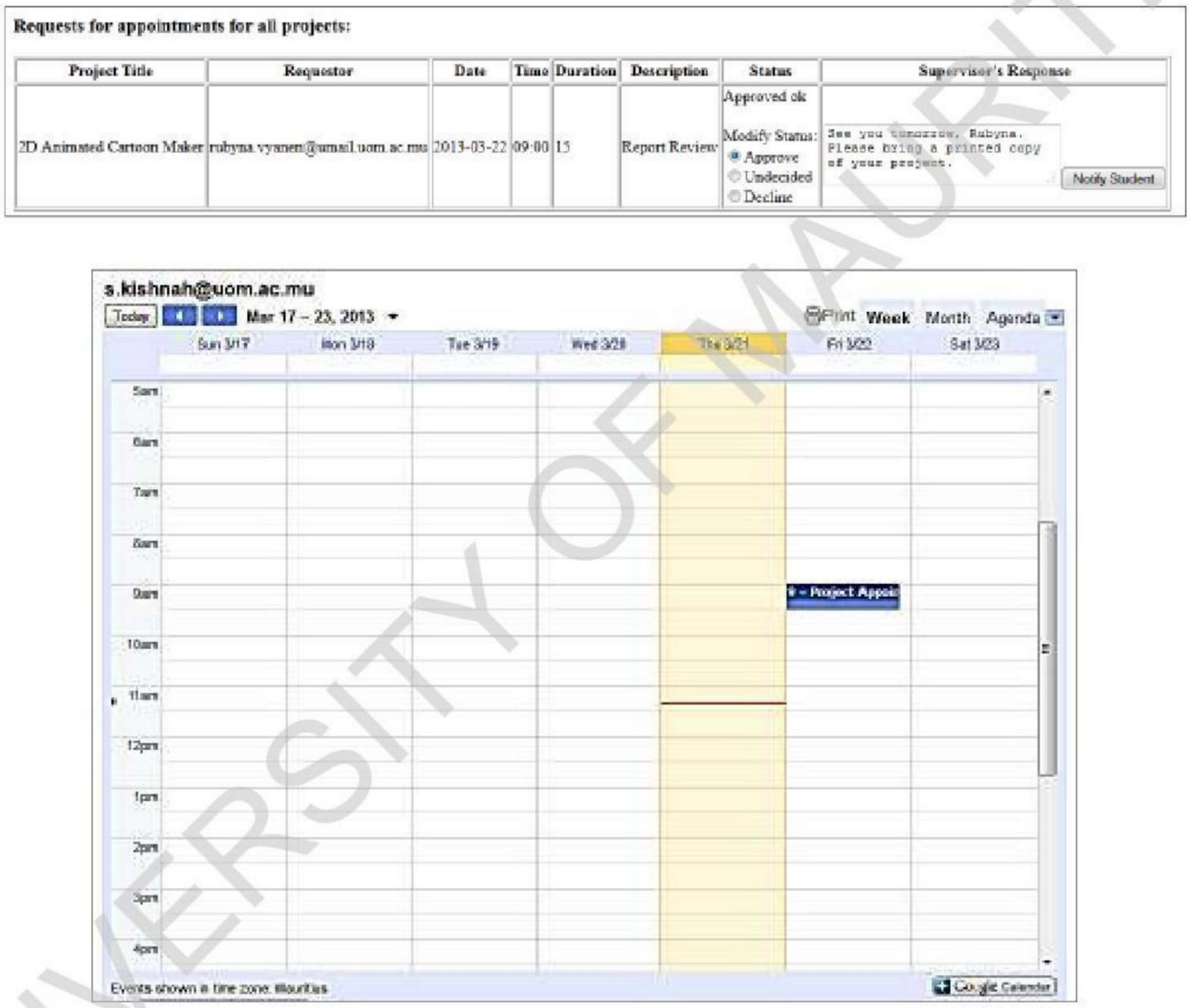


Requests for appointments for all projects:

Project Title	Requestor	Date	Time	Duration	Description	Status	Supervisor's Response
2D Animated Cartoon Maker	rubyna.vyanen@umail.uom.ac.mu	2013-03-22	09:00	15	Report Review	undecided Modify Status: Approve Undecided Decline	Notify Student

Figure 125: Request is displayed.

25. Check if appointment is added to calendar after approval.



Requests for appointments for all projects:

Project Title	Requestor	Date	Time	Duration	Description	Status	Supervisor's Response
2D Animated Cartoon Maker	rubyna.vyanen@umail.uom.ac.mu	2013-03-22	09:00	15	Report Review	Approved ok Modify Status: Approve Undecided Decline	See you tomorrow, Rubyna. Please bring a printed copy of your project. Notify Student

Figure 126: Appointment is added to the supervisor's calendar and student is notified.

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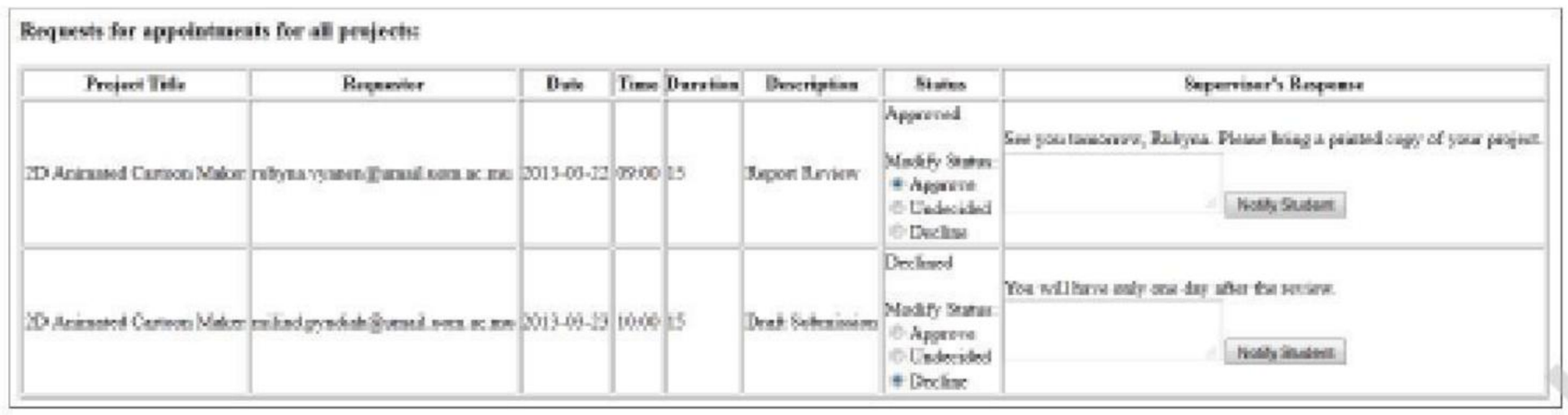
26. Check if appointment is added to calendar if request is rejected.



Requests for appointments for all projects:

Project Title	Requester	Date	Time	Duration	Description	Status	Supervisor's Response
2D Animated Cartoon Maker	rubyna.vyanen@umail.uom.ac.mu	2013-03-22	09:00	15	Report Review	Approved Modify Status: * Approve Undecided Decline	See you tomorrow, Rubyna. Please bring a printed copy of your project. Notify Student
2D Animated Cartoon Maker	milind.pyndiah@umail.uom.ac.mu	2013-03-23	10:00	15	Draft Submission	Declined Modify Status: Approve Undecided * Decline	You will have only one day after the review. Notify Student

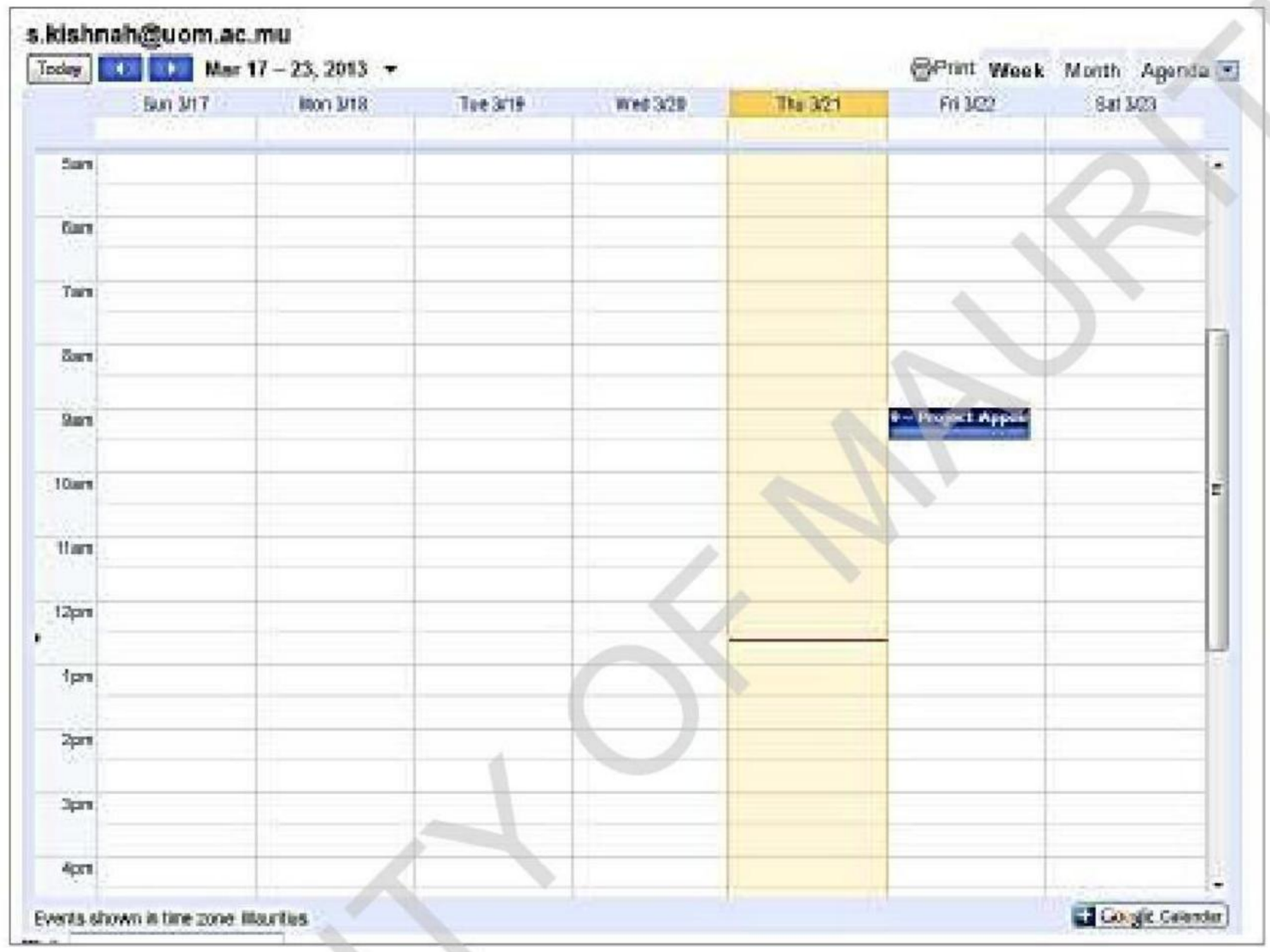
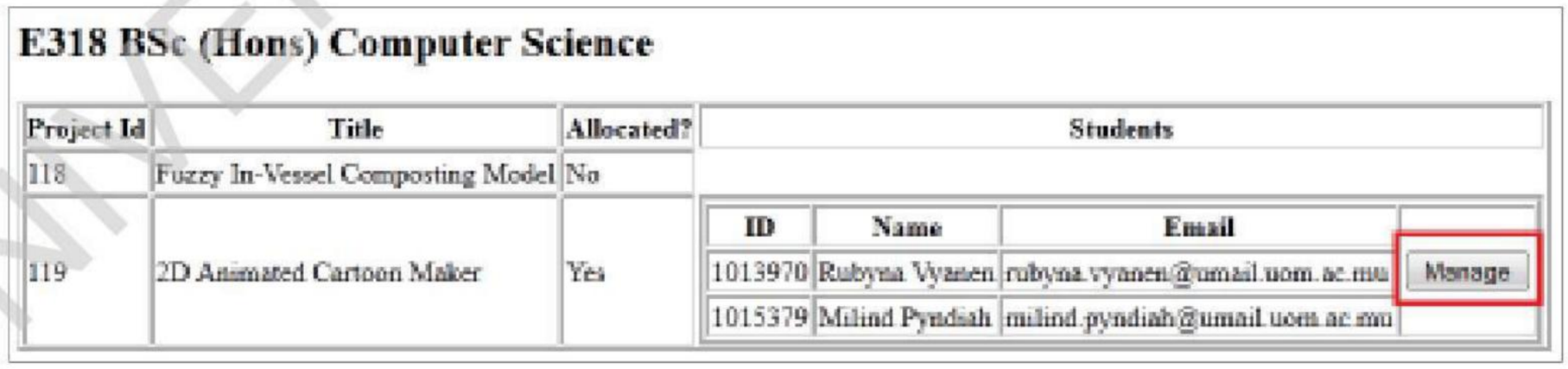


Figure 127: Appointment is not added to the supervisor's calendar and student is notified.

27. Click on "Manage" and check if there exist project details.



E318 BSc (Hons) Computer Science

Project Id	Title	Allocated?	Students			
118	Fuzzy In-Vessel Composting Model	No				
119	2D Animated Cartoon Maker	Yes	ID	Name	Email	
			1013970	Rubyna Vyanen	rubyna.vyanen@umail.uom.ac.mu	Manage
			1015379	Milind Pyndiah	milind.pyndiah@umail.uom.ac.mu	

Figure 128: The supervisor is able to see project details.

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28. Check that a list of tasks for the project exists.

Figure 129: A list of tasks for the project is displayed.

29. Click on "X" to remove a task comment.

Figure 130: The supervisor is alerted and the comment is deleted upon confirmation.

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30. Click on “Edit” to change a task comment.

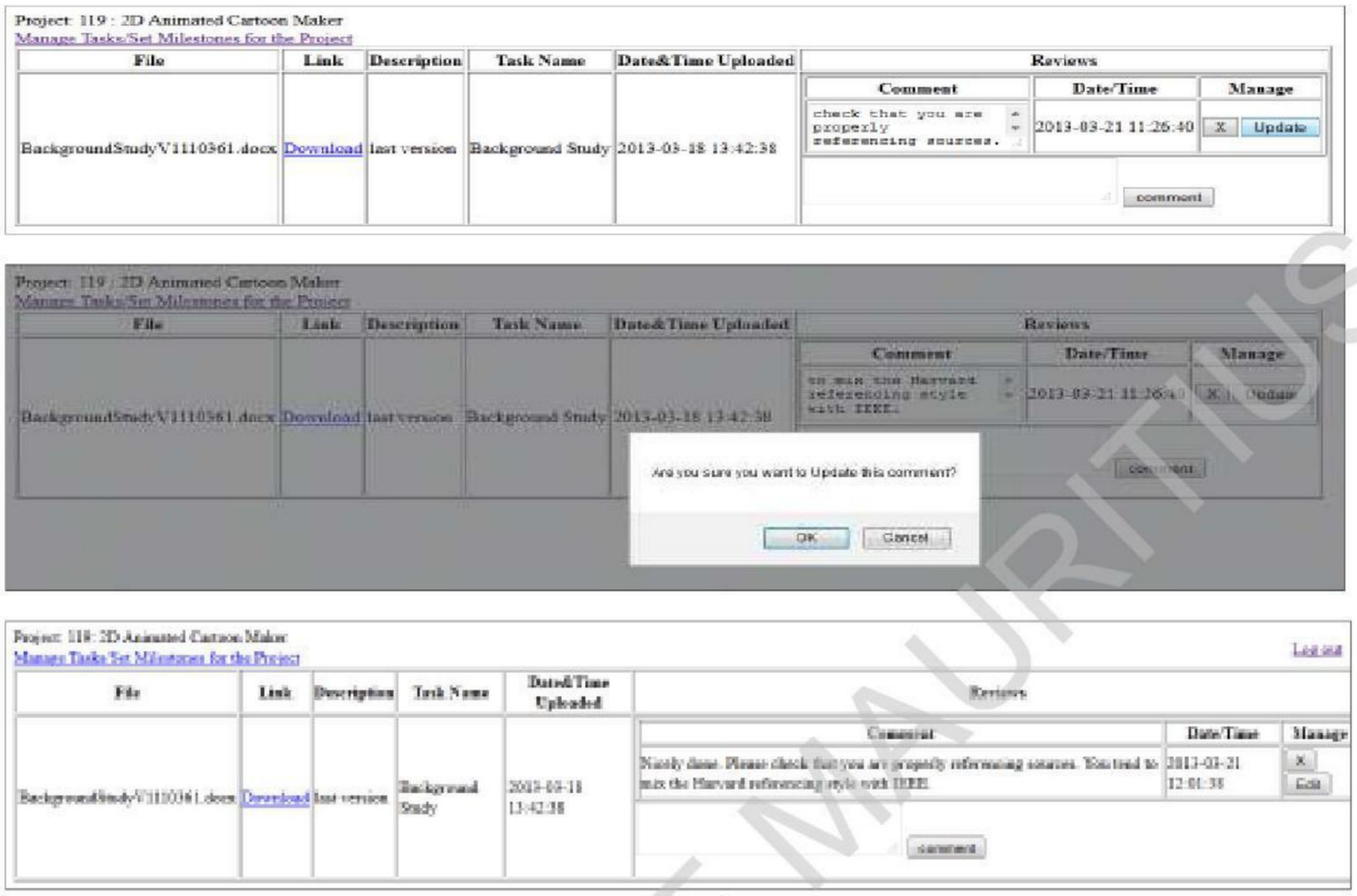

Figure 131: The supervisor is alerted and the comment is updated upon confirmation.

31. Click on combobox “Task Name” and check if it is populated with the project tasks.

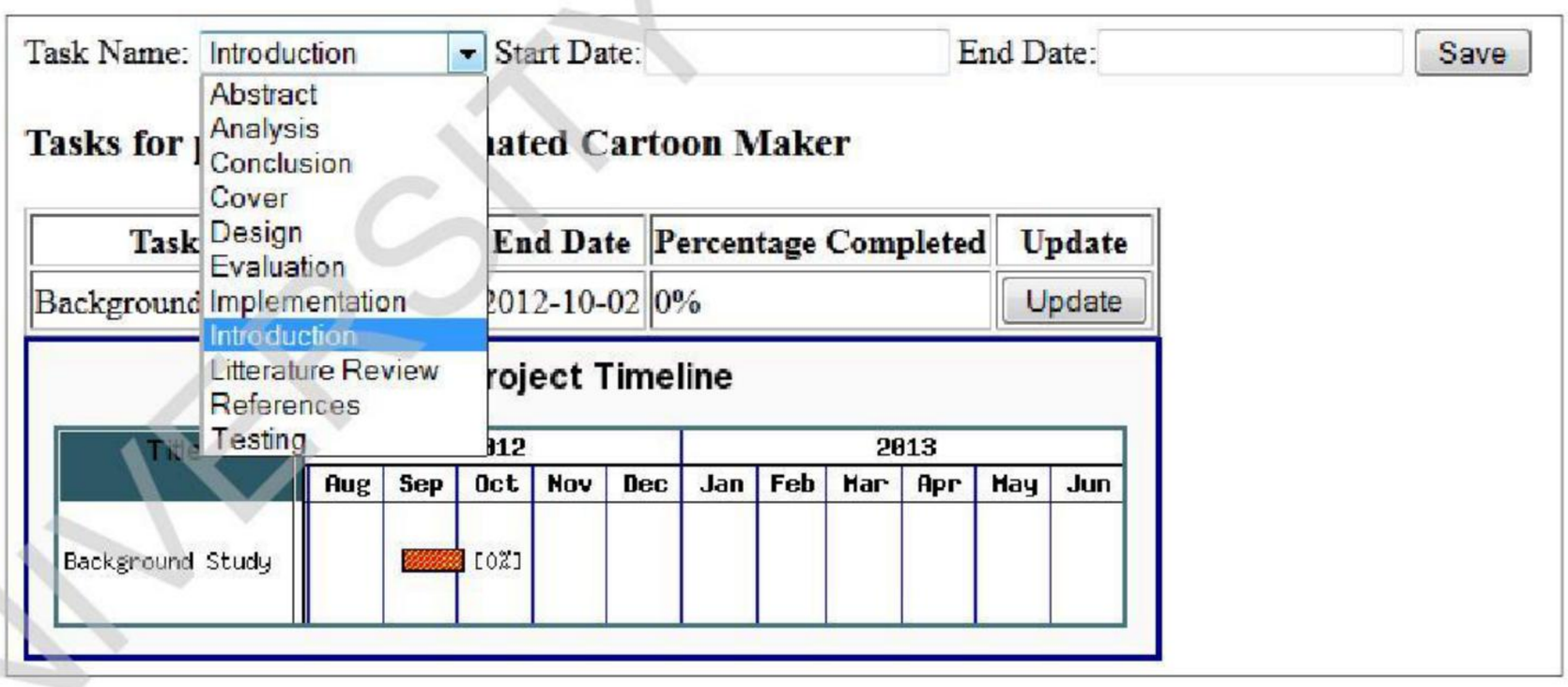

Figure 132: The combobox is populated with the project tasks.

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32. Click on “Start Date”textbox and check if date picker appears.

Figure 133: Date picker appears and lets the supervisor choose a start date.

33. Click on “End Date”textbox and check if date picker appears.

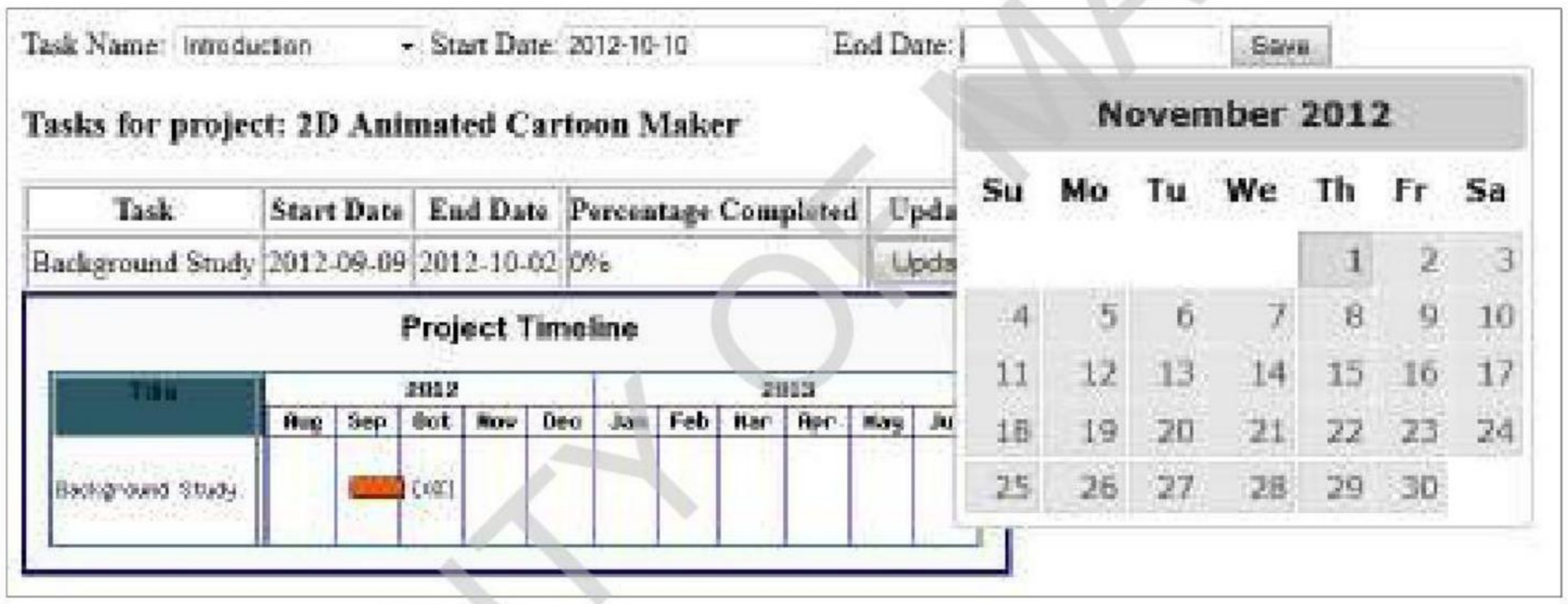

Figure 134: Date picker appears and lets the supervisor choose an end date.

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34. Click on "Save" and check if task is added.

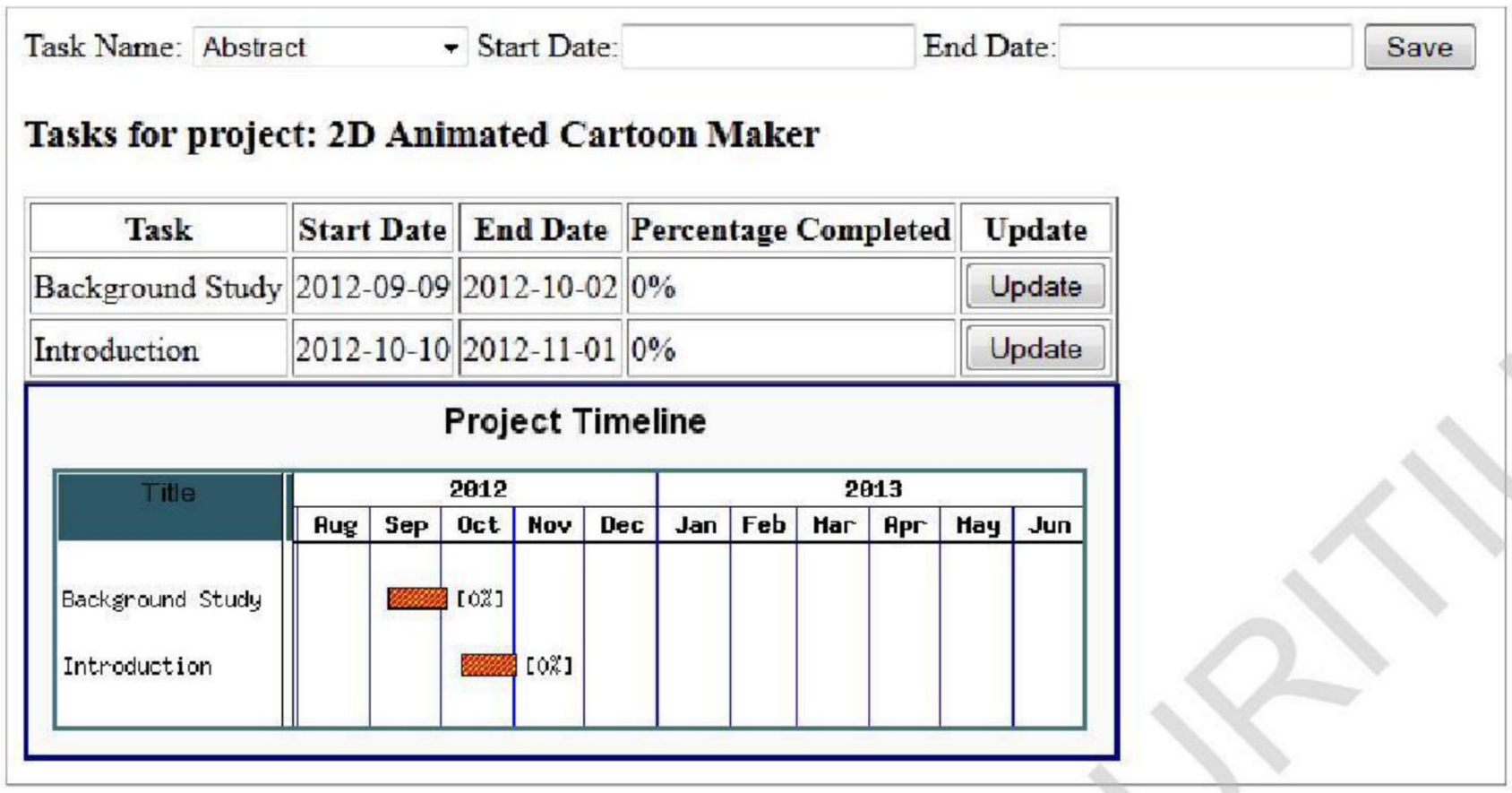

Figure 135: Task is added and displayed.

35. Click on "Update" and check if Start Date, End Date and Percentage Completed can be edited.

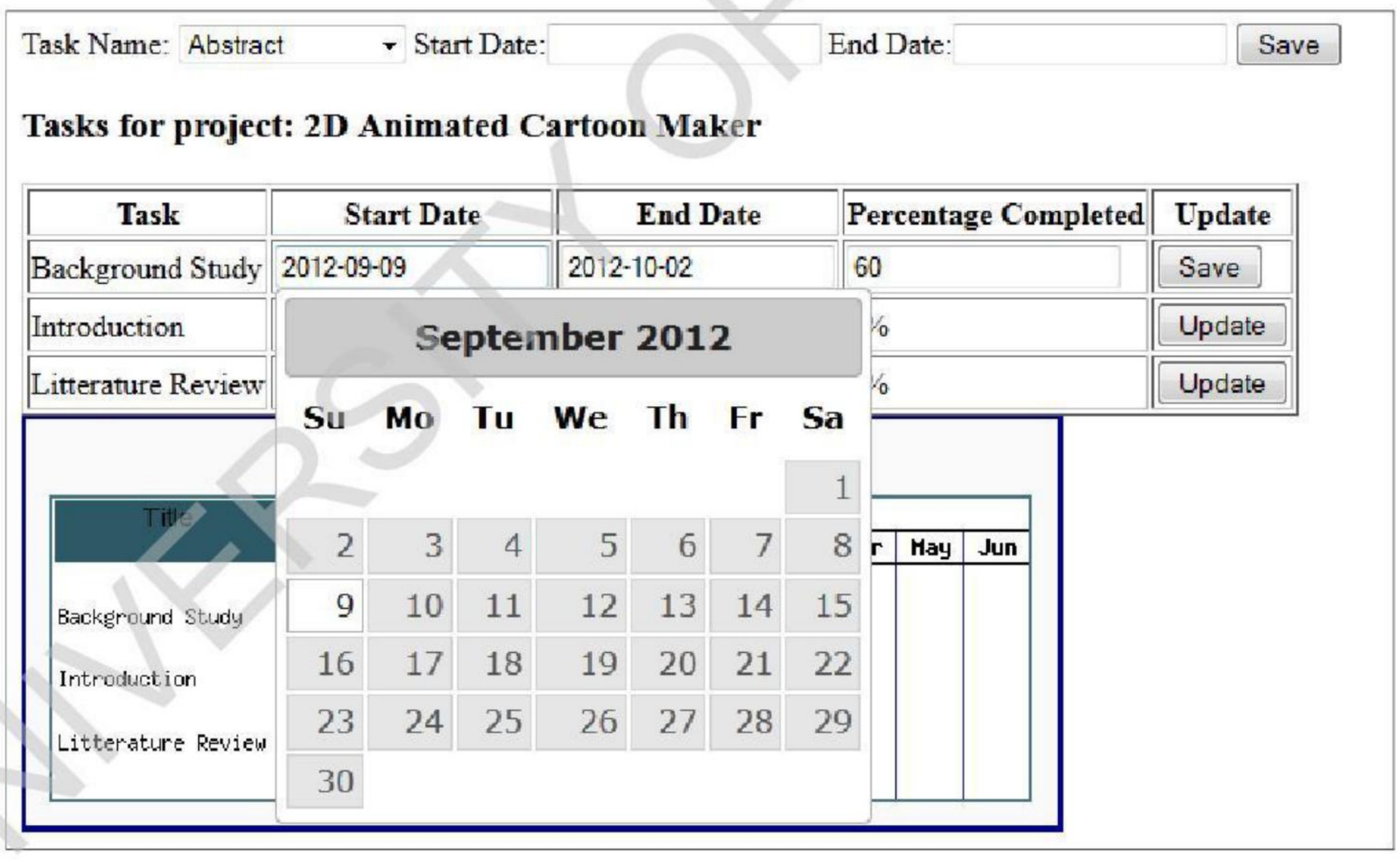

Figure 136: Start Date, End Date and Percentage Completed are editable.

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36. Enter a date range beyond the scale of the timeline.

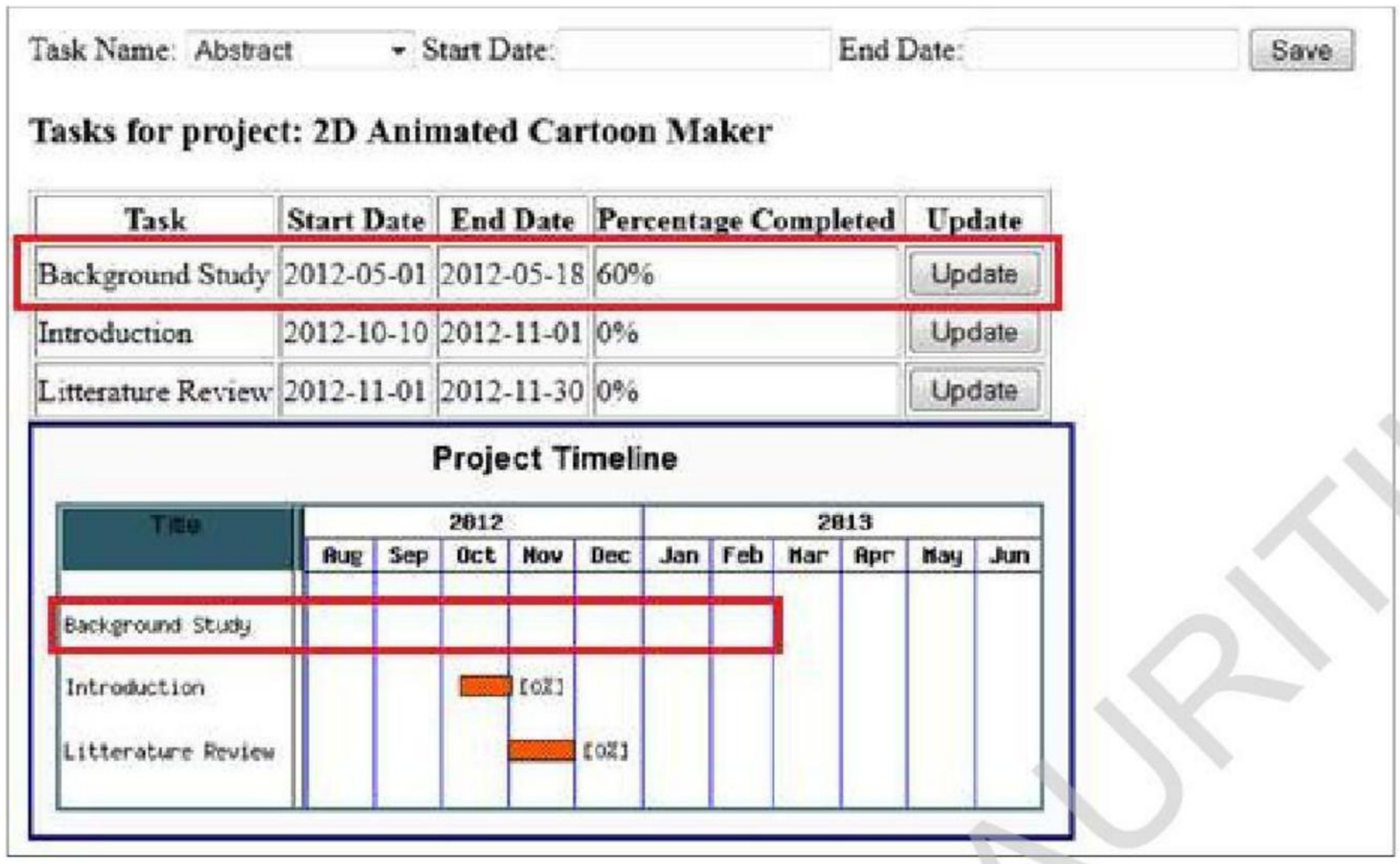

Figure 137: The activity bar for the task is not plotted.

37. Click on "Update" and check if textboxes for Percentage Completed is enabled and editable.

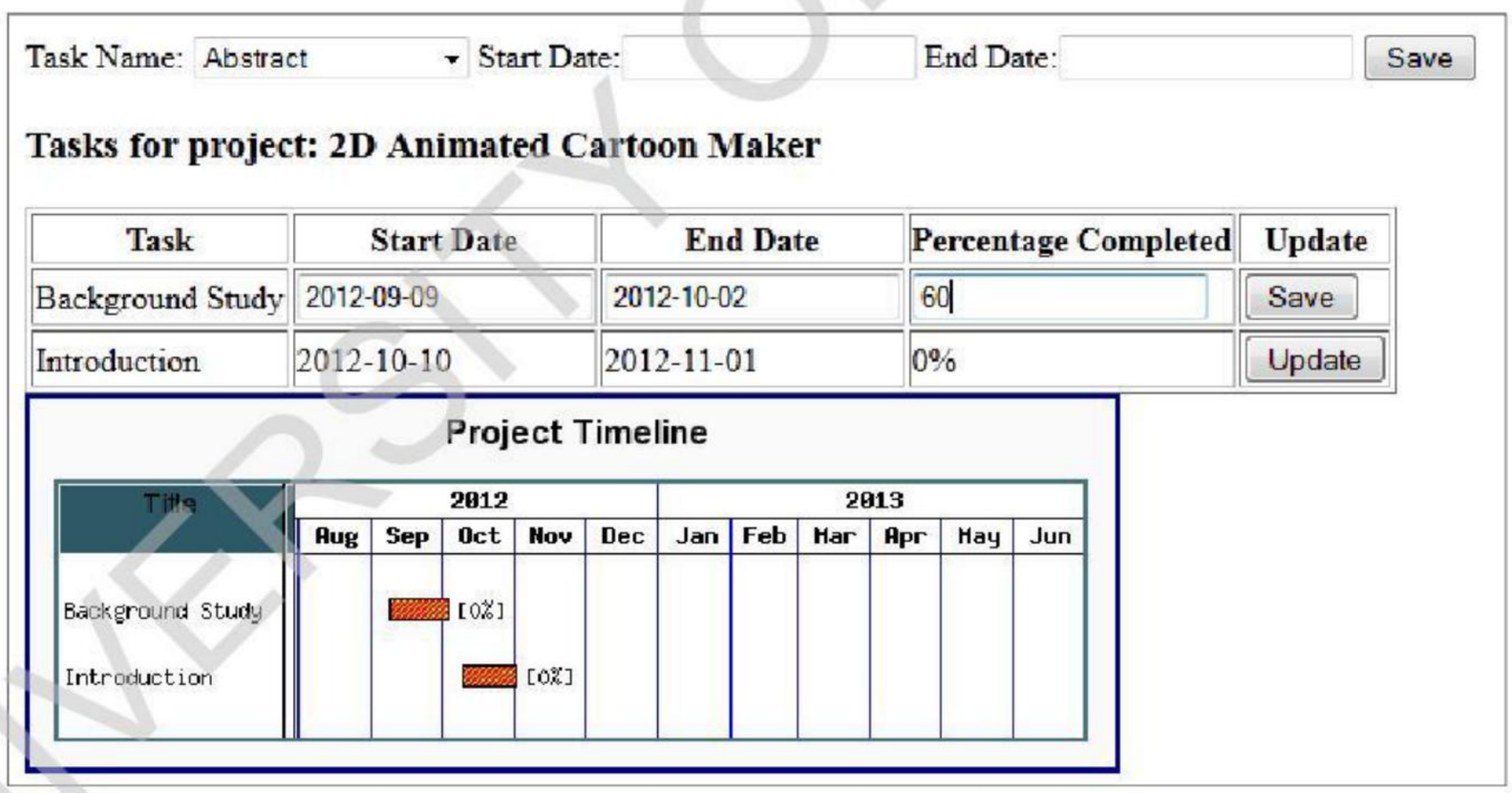

Figure 138: Percentage Completed is enabled and editable.

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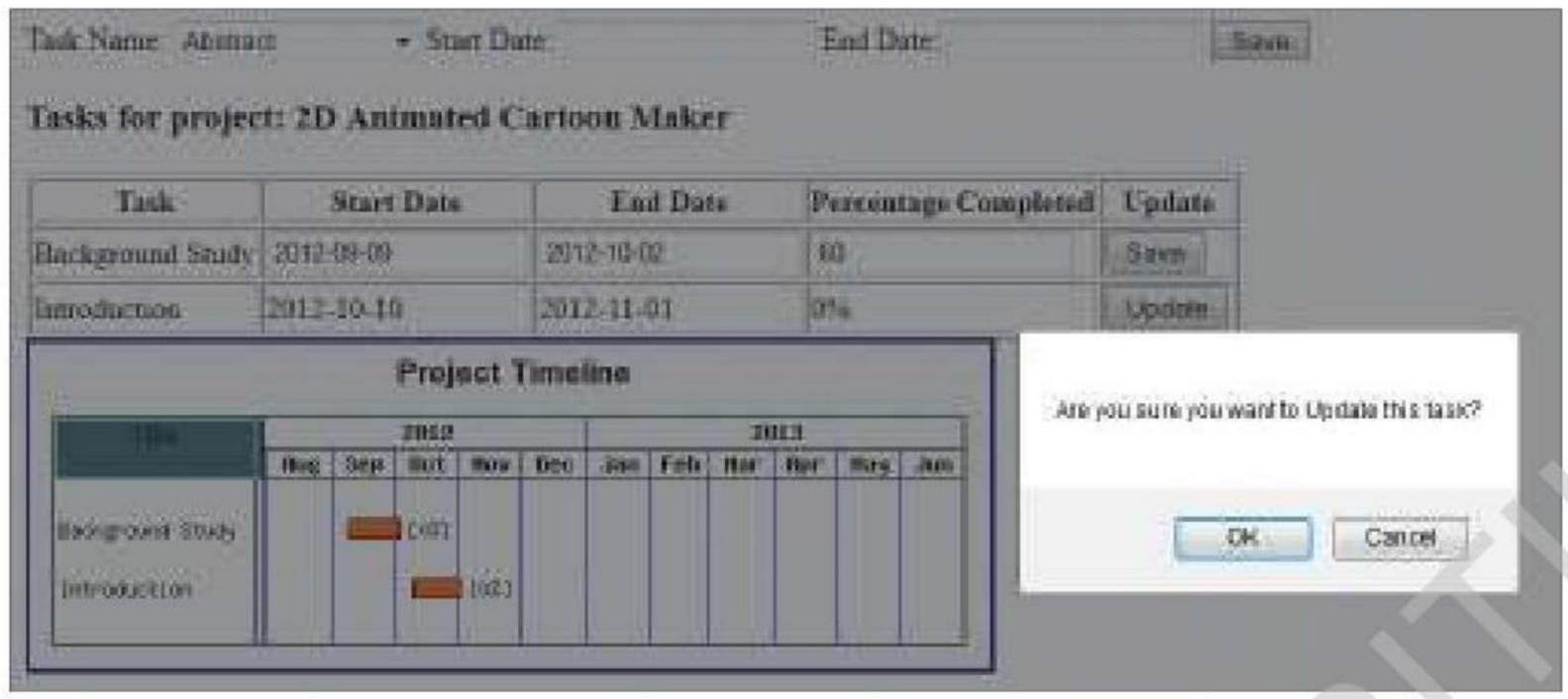
38. Enter value for Percentage Completed and Click on “Save”.



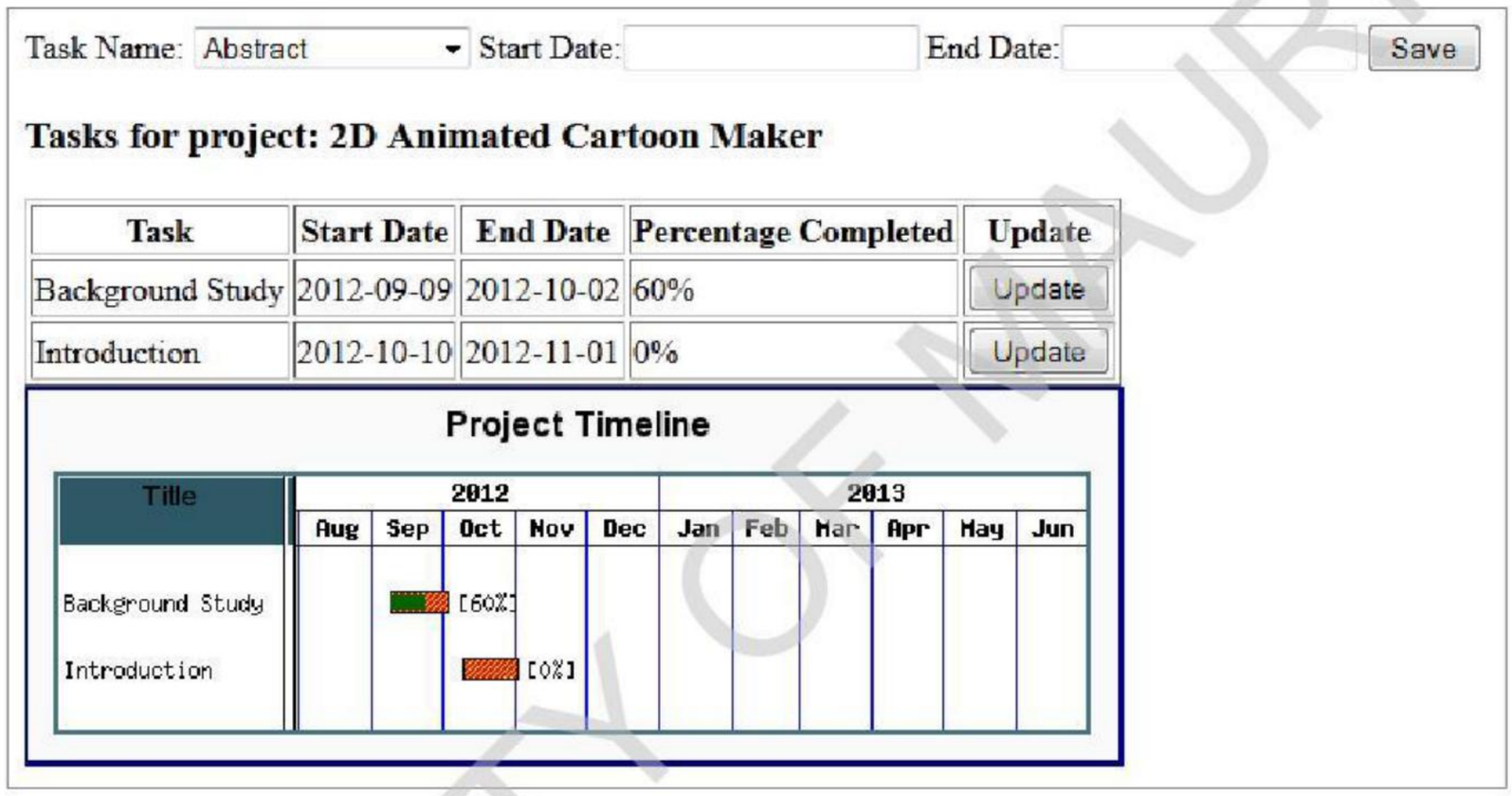


Figure 139: The supervisor is alerted and the value is reflected on the activity bar upon confirmation.

39. Click on “Browse” and check if File Upload box appears.

Figure 140: File Upload box appears.

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40. Click on the combobox "Task" and check if it is populated with tasks already set by the supervisor.

Figure 141: The combobox is populated with only tasks already set by the supervisor.

41. Click on "Upload Task" and check if the file is uploaded under the given task added.

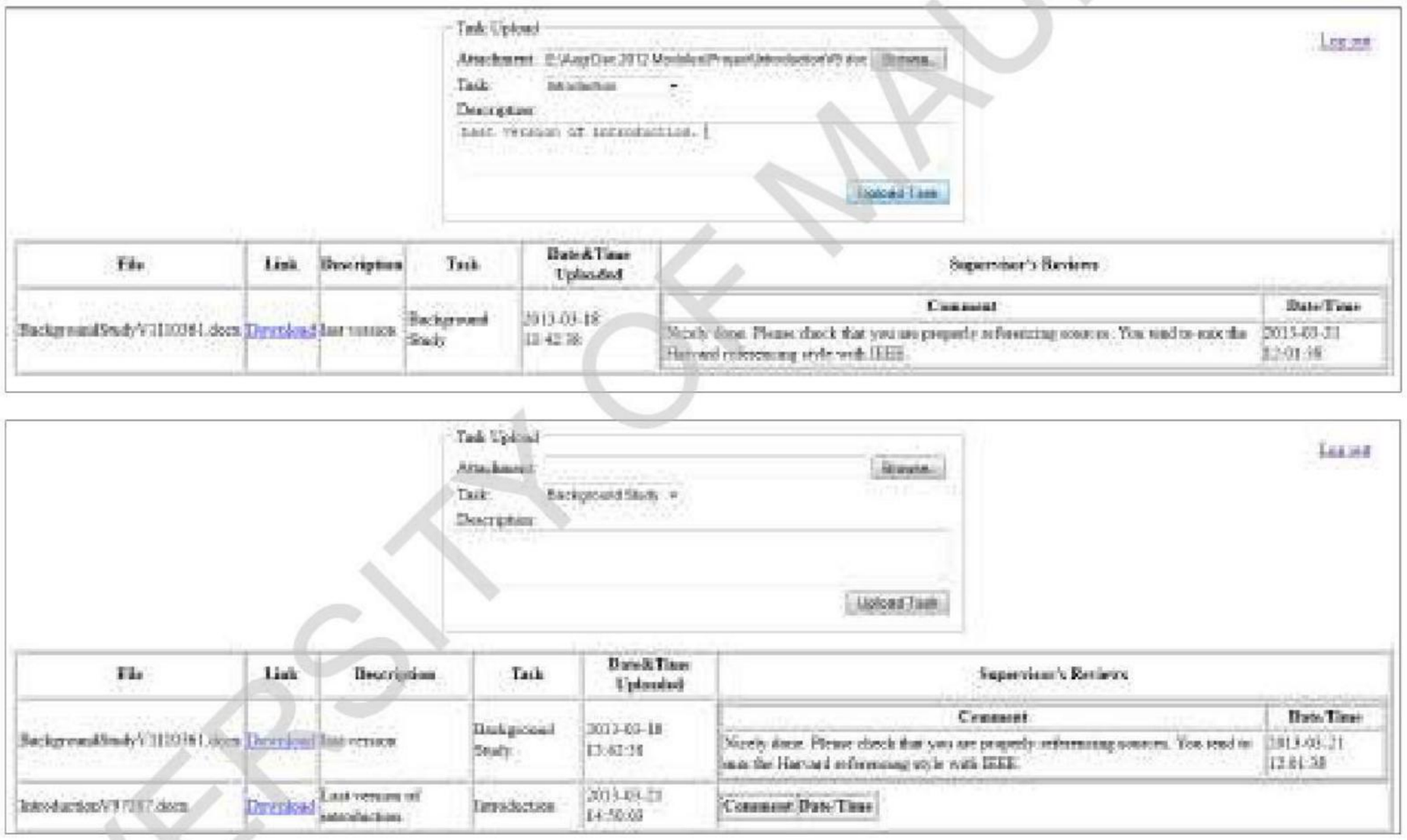

Figure 142: The file is uploaded under the given task and is added.

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42. Check if supervisor has provided comments for the work.

Figure 143: Supervisor's comments for the particular task is displayed.

43. Check if Gantt chart is displayed.

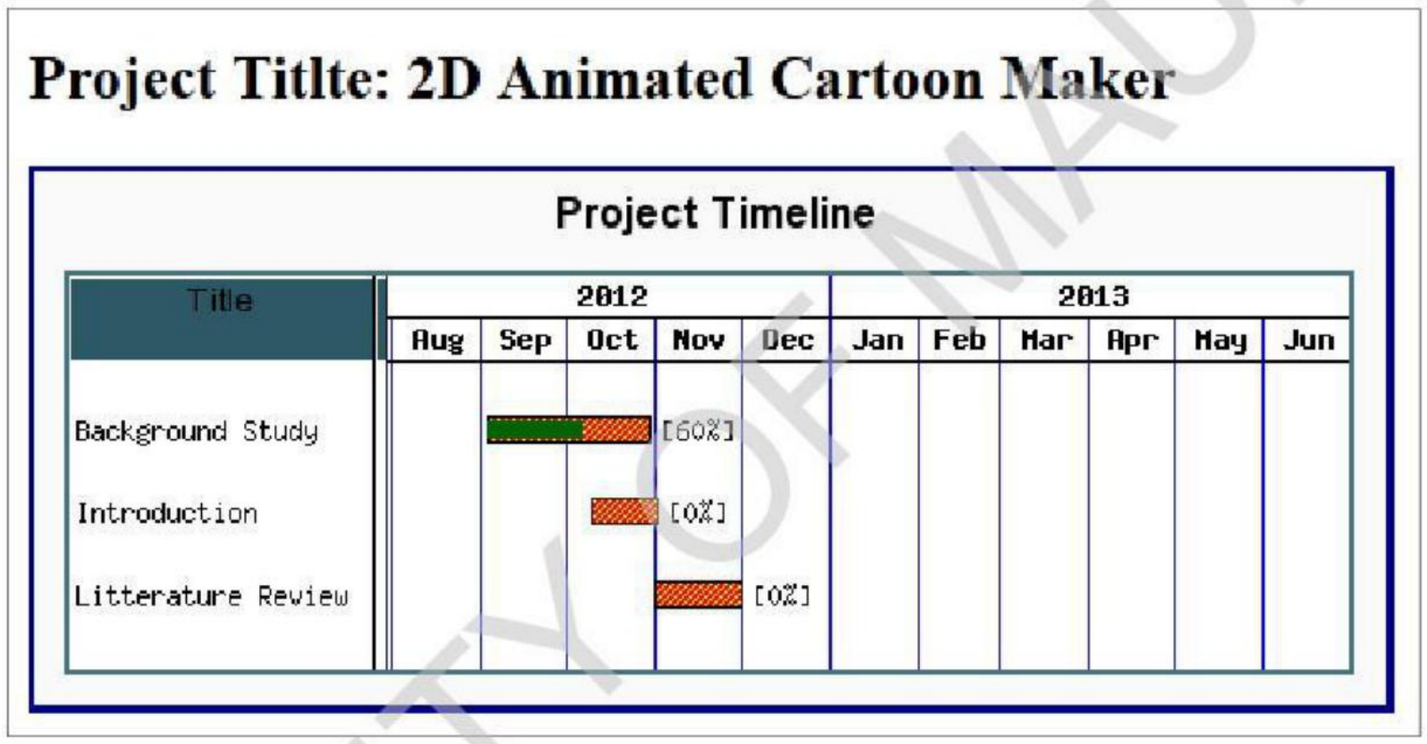

Figure 144: Gantt chart is displayed.

44. Click on combobox "Starting Time" and check if it is populated with valid working hours.

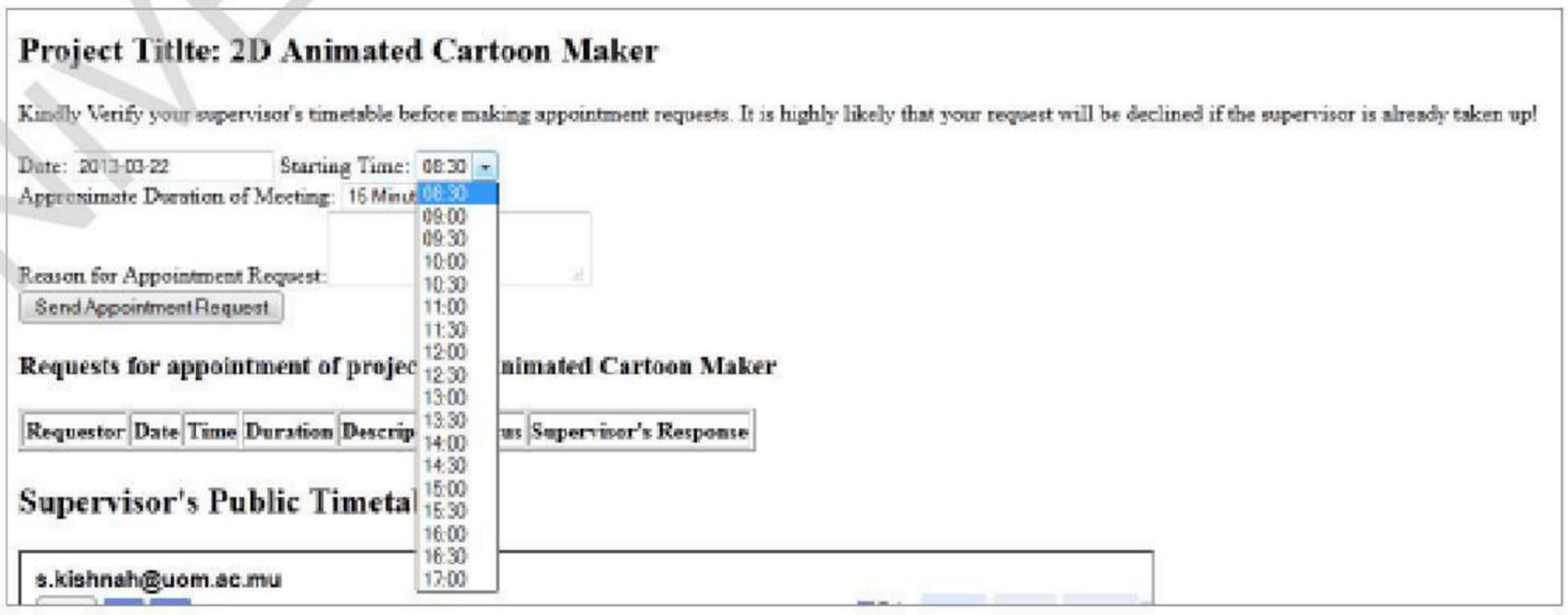

Figure 145: Combobox is populated with valid working hours.

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45. Click on combobox "Approximate Duration of Meeting" and check if it is populated with reasonable meeting durations.

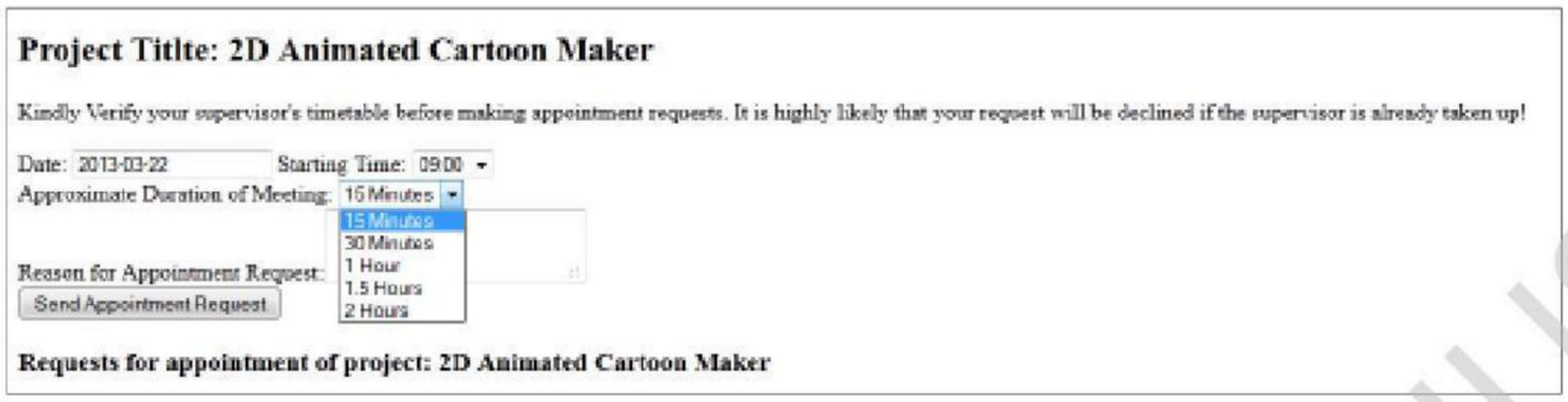

Figure 146: Combobox is populated with reasonable meeting durations.

46. Click on "Send Appointment Request" and check if it is displayed with a default status of "undecided".

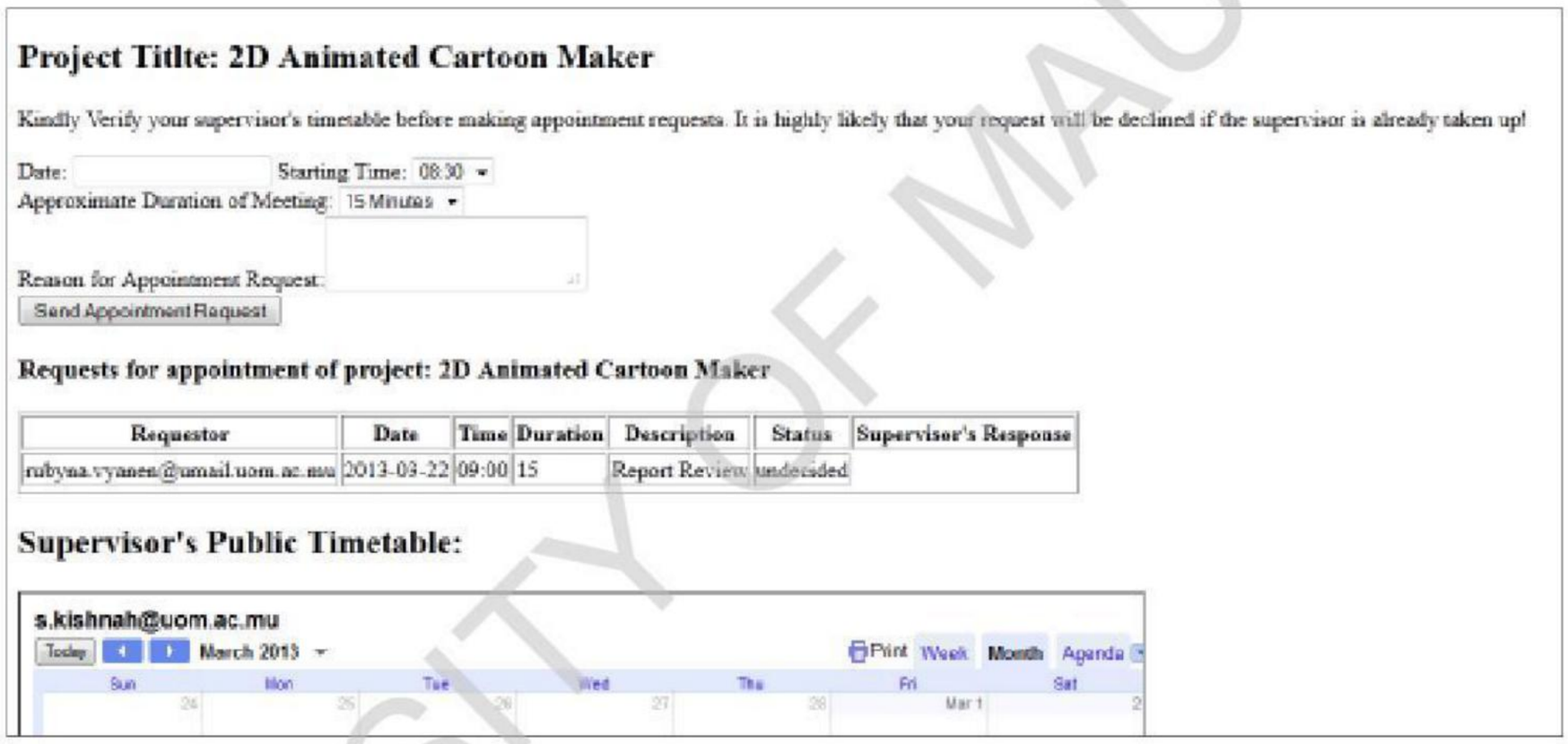

Figure 147: Meeting request is sent to the supervisor and added to a list of request with a default status of "undecided".

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47. Check if the meeting is accepted and added to the supervisor's calendar.

Figure 148: Appointment is added to the supervisor's calendar and the student is notified.

48. Check if the meeting is rejected and not added to the supervisor's calendar.

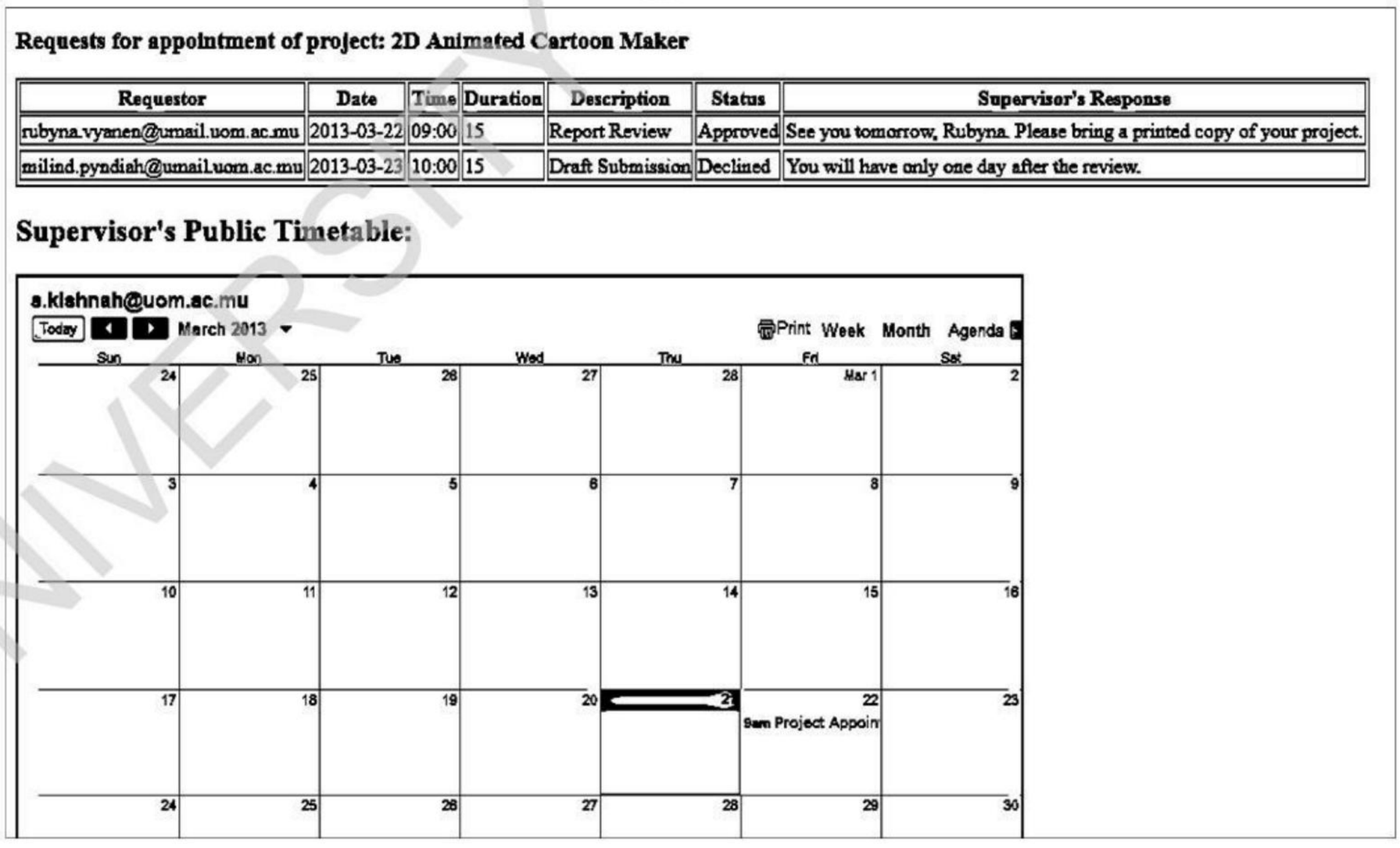

Figure 149: Appointment is not added to the supervisor's calendar and student is notified.

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49. Enter search terms and select radio button “Whole Project Description” and Click on “Search”.

Figure 150: Seach Term is entered and “Search” button is clicked.

50. A list of projects containing the search keyword found in project information is displayed.

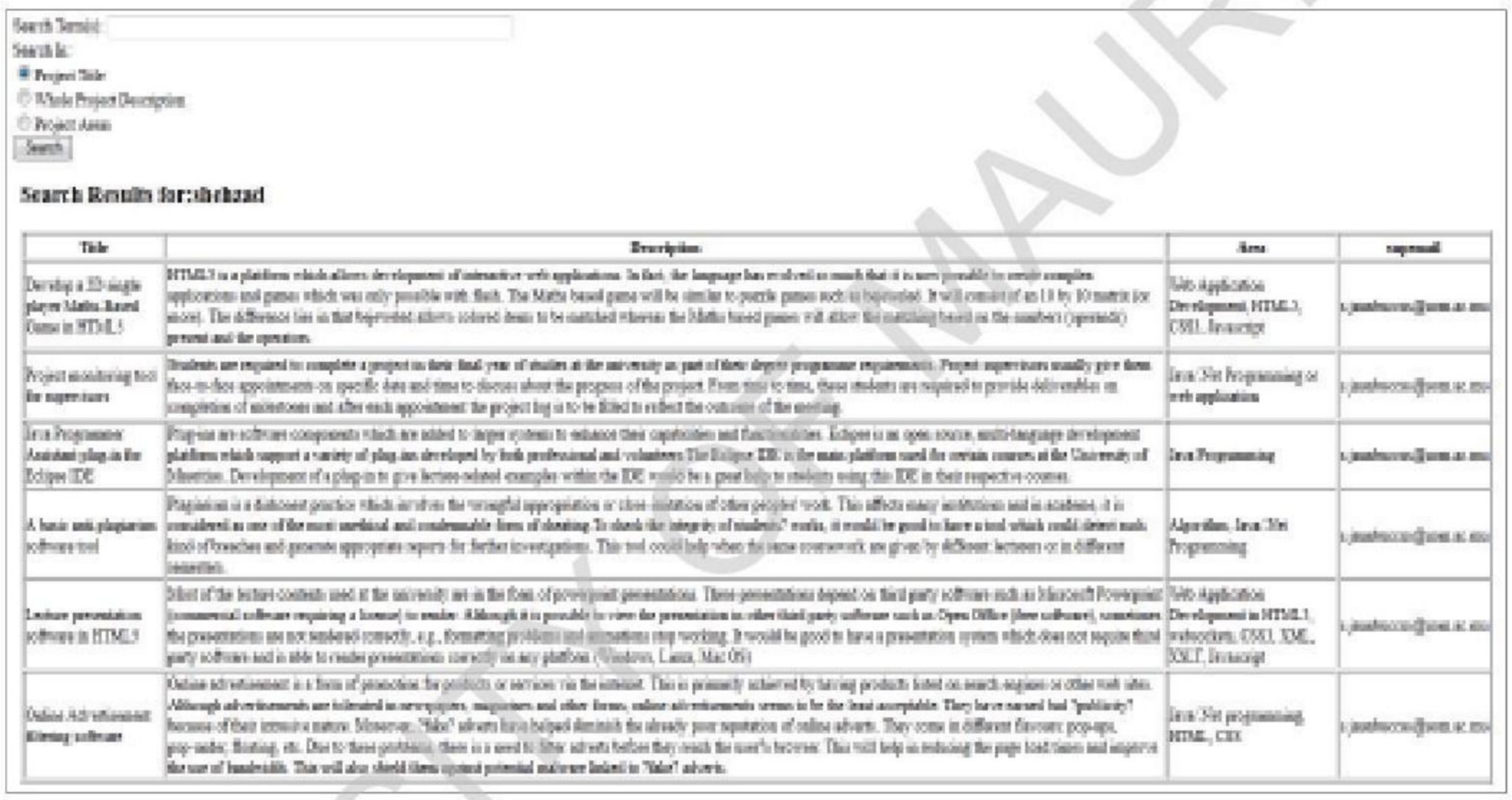

Figure 151: Everything related to the search term entered is displayed.

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