DEVELOPMENT OF A DATA MANAGEMENT SYSTEM FOR STUDENTS' FINAL YEAR PROJECTS CASE STUDY: DEPARTMENT OF INFORMATION SYSTEMS

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Abstract
With the advances of information technology nowadays, it is more than appropriate for an educational institution to make use of the existing technology to ease the process of managing students' data and grades. One of the applications needed by the Information Systems department is a data management system for student's final year projects that can manage their grades and generate full reports.
This system will be developed as a web-based system, with access limited only to the university's local network. To design this new system, analyses of the current final year project procedure, data and grade management will be conducted. The results of the analyses will form the foundation of the design and development of a database management system – the core support of the data management system. The interface of the system will be designed and built on the principles of usability.
It is aimed that both the department's administration and the Head of Department can benefit from using this system to input, manage and view students' final year projects and the respective grades.

***Keyword** : online data management, database, user friendly, usability*

1. INTRODUCTION

The fast-paced growth and development of information and communication technology (ICT) has brought on significant changes to the mindsets, workflows and lifestyle of society. One of the fields most impacted by this progress is education. Not only has ICT become one of the most attractive fields of study in tertiary education, but its influence and use within the educational institutions has become indispensable. Both academic and administrative processes have been renewed and realigned by ICT implementations, shifting the conventional paper-based operations and data storage to online systems and databases.

The Information Systems department at Universitas Pelita Harapan's School of Computing is one of the departments that strive to stay on the leading edge of ICT implementations and integrations to improve not only its academic performance but also its administrative efficiency.

One of the regular yet administration-intensive processes that occur within this department is the procedure for students' final year theses and projects. This process begins with students' proposals of thesis or project topics which must be approved by supervising lecturers and ends after grades are given by supervising lecturers and examiners. Currently, all thesis/project data and grades given during this period are recorded on paper-based forms saved in student's individual folder. Such data storage and processing hinders the department when trying to search, retrieve and analyze students' final year thesis/project data. Therefore, the department of Information Systems requires a centralized and more practical way of processing grades and data for final year students.

To tackle these issues, this research aims to develop a database management system to store and manage students' final year project data and grades. To make sure that the data is accessible at all times, it will be developed as an online system with access currently limited to the university's network. In addition to the basic data management features, this system will also allow the department head and administration staff to generate reports, calculate grade averages from multiple examination points and change the weighting-scheme of the final year thesis or project. A final and important aspect of the system is its user-friendliness and usability considering the background and skill of the target users and their learning curve.

2. LITERATURE REVIEW

Data management is the core of every organization that wishes to succeed in this information age. Commercial entities rely heavily on customer and product information processing to support its decision making in targeting the right market. Educational institutions, especially tertiary education institutions, require a data management system in order to function properly since accurate information is crucial for each student's academic record.

To accommodate this need, a database management system (DBMS) is used. Ramakrishnan, e.a. (2000) defines a DBMS as software designed to assist in maintaining and utilizing large collections of data. Rob, e.a. (2004) completes this definition by defining a DBMS as a collection of programs that manages database structure and controls access to the data stored in the database. By using a DBMS, the department of Information Systems not only controls access and manage (add, edit, delete) information but it is also able to provide quick and consistent retrieval of this information to answer any inquiry regarding students' final year projects/theses.

Several advantages of a DBMS include: (1) efficient data access (2) data integrity and security (3) data administration, and (4) concurrent access and crash recovery (Ramakrishan, e.a, 2000). These advantages combined with a server-side web scripting language will provide the necessary building blocks to develop the required system. As for the database itself, MySQL is chosen for its versatility and vast use in the current web development. It is also described as "one of the most used and powerful databases on the web today" (Deitel and Deitel, 2009).

Aside from the technical aspect of the system development, an important aspect of this system is its user-friendliness and usability. Therefore, there are interface design principles and also specifically website design principles used in designing the user interface, namely the Eight Golden Rules (Shneiderman, 1998) and Sklar's (2009) website design principles. The Eight Golden Rules are:

1. Strive for consistency
2. Enable frequent users to use shortcuts
3. Offer informative feedback
4. Design dialogs to yield closure
5. Offer error prevention and simple error handling
6. Permit easy reversal of actions
7. Support internal locus of control
8. Reduce short-term memory load

Sklar (2009) suggests designing the website while focusing not only on the user but also the screen or computer medium. In other words, the user must be comfortable enough while viewing the site yet the primary goal of the design is to create Web pages for the computer medium. Some of the principles which apply to the proposed system's design are:

1. Make your design portable
   Accessible by users with different browsers, operating systems and computer platforms.
2. Design for low bandwidth
   The website must not overloaded with large graphic files.
3. Plan for easy access to your information
   Organize content in a meaningful way; present it as a set of navigable information.
4. Plan for clear presentation for your information
   Provide clear navigation with friendly colors and fonts.
5. Plan for smooth transitions
   The website must look unified or consistent
6. Design for interaction
   Make reading easier and organize content
7. Guide the user's eye
   Decide where users should focus their attention
8. Keep a flat hierarchy
   Simplify layers of website navigation

3. RESEARCH METHOD

Before developing the system, a full understanding of the current workflow is required. This is then modeled using UML to provide an overview of what the system should encompass and to detect the shortcomings of the current workflow and improve them in the remodeling. Consequently, Information Systems students at Universitas Pelita Harapan are given two options to complete their final year of study. The first is a period of internship at a company or organization and the second is a final year thesis that must be written as part of a research for an organization or company. Both options will have the same start and end point of proposing a research topic and examination by three examiners. The flows of both tracks mostly differ in the final grade weighting scheme. A more specific overview of both thesis and internship graduating tracks can be found in figure 1 and figure 2 respectively.

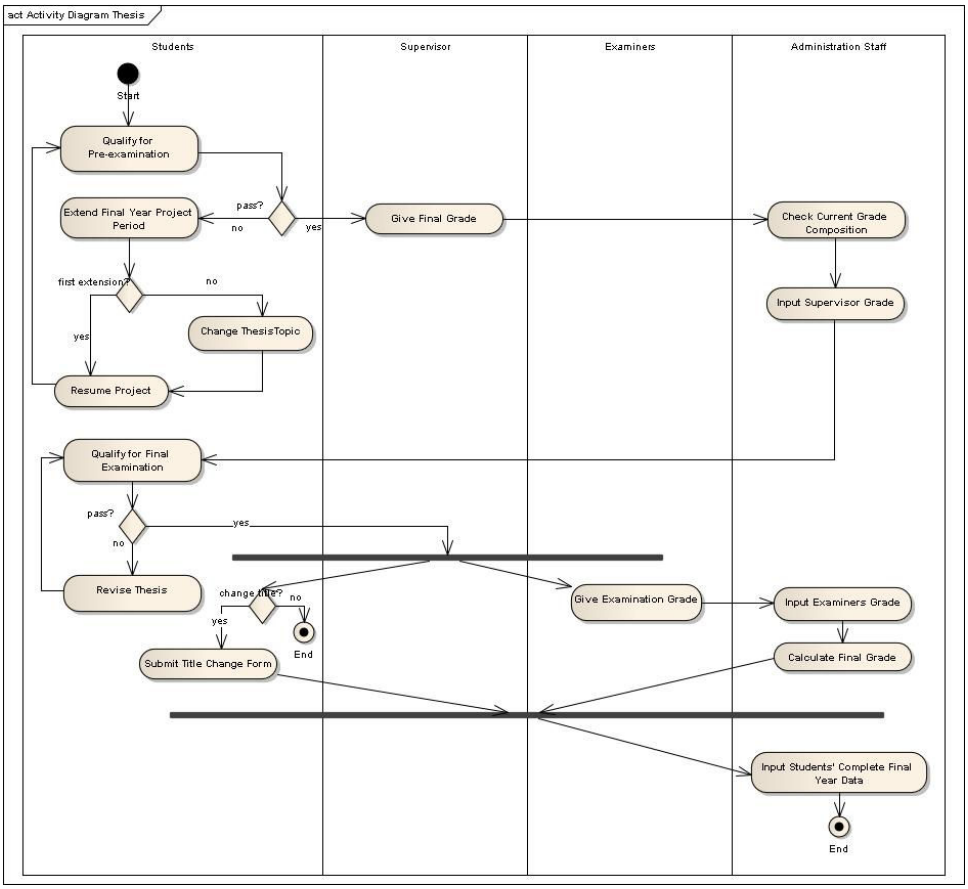

Figure 1. Activity Diagram of Current Final Year Thesis Track

Generally, the process of final year project is as follows:

1. Each final year student starts by submitting and presenting a topic of choice to lecturers
   The lecturers will then consider whether the proposed project meets the requirements of a final year project and, if it does, which lecturers will supervise the student.
2. Each student will be assigned two lecturers as his/her thesis advisors.
   One of the advisors will function as the main/lead advisor during the project. In the thesis track, both advisors will make sure that the student has fulfilled the examination requirements and completed the project by conducting a pre-examination and giving a pre-examination grade (which will be calculated in the final grade). However, the internship track does not include the pre-examination grade in the final grade.
3. Three lecturers will examine each student's work upon completion
4. If deemed inadequate, the student will need to revise his/her thesis and be re-examined.
5. After calculation of the total grade, the student is given one week to do final revisions to the thesis
6. A final graduation examination (*yudisium*) will take place to determine whether the student involved has fulfilled all the necessary requirements and is able to graduate

If a student is unable to finish his/her project in one semester, extensions can be granted with a maximum of two semesters. Incompletion after the extension period will require the student to change topic and advisors and restart the final year project track. Title changes are allowed during the project but will require the student to submit the proper form to the administration.

All documents and records of thesis proposal, topic changes, pre-examination grades and final examination grades are kept on separate forms, which will be forwarded to the academic bureau at the university. Copies of these documents are stored at the faculty in each student's folders. This data storage issue is a major shortcoming considering that each student will have more than four forms each in the storage, containing various raw and calculated data. Several other shortcomings in the process described above are data access and availability. Although there is a small chance of modifying the grades on the files, a more secure storage system is required. Moreover, since physical access is required to access the data, availability of the data has become very limited

and dependent upon certain staff that holds access to the storage facility. Examiners and other administrators have stumbled upon this problem several times especially during examination period.

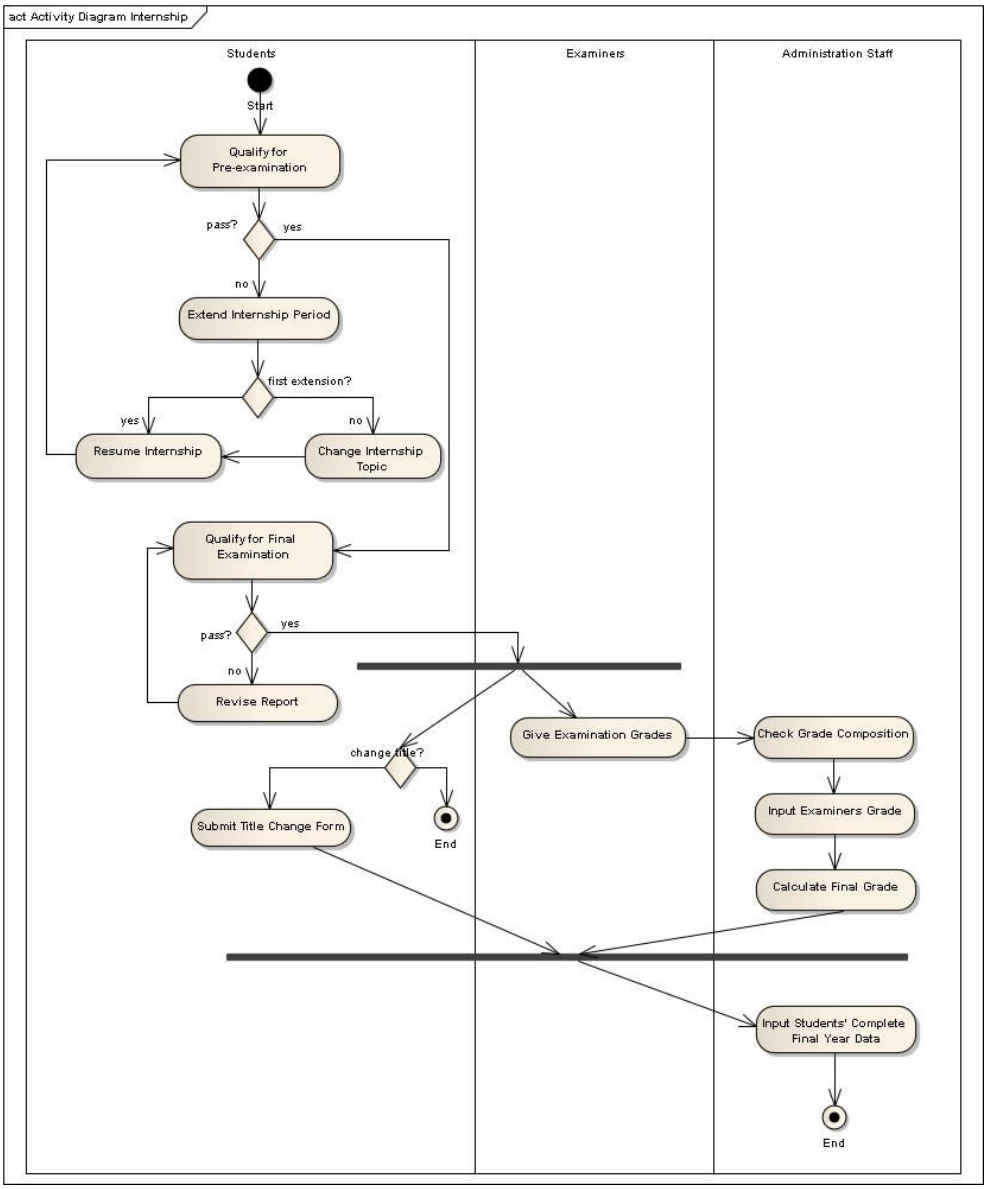

Figure 2. Activity Diagram of Current Final Year Internship Track

From the shortcomings and current workflows above and interview with users, the following lists of requirements are determined.

Functional Requirements

Functional requirements (or user requirements) relate directly to a process the system has to perform (Dennis, e.a, 2005). In the case of this system, the functional requirements are as follows:

1. Students' data and grade management
   User will be able to add, edit and delete students' personal and grade information; allowing users to set progress status of each student in his/her final year project track of choice (i.e. internship or thesis) and add an abstract for each student. The grade information includes all grades given by supervisors and examiners.
2. Lecturers' data management

User will be able to add, edit and delete lecturers' personal information and link them to supervised students.

3. Grade management
   Since the grading system is a composition of weights of grades for various aspects of the final project, users must be able to change this composition and assign them to a selected group of students.
4. Semester management
   Since there will be a graduating date set for each semester which will influence the status and extension possibility of students, user must be able to set that date in the system for each semester.
5. Reports generation
   The system must be able to generate summaries of overall grades, average grades, grade comparisons and average completion per academic year.

Non-functional Requirements

Nonfunctional requirements refer to behavioral properties that the system must have, such as performance and usability (Dennis, e.a, 2005). These requirements describe a variety of characteristics regarding the system, such as operational, performance, security and cultural and political. However, since the proposed system is limited in use and number of users, the nonfunctional requirements may not be as extensive as a system of a larger scope
The nonfunctional requirements of the proposed system are as follows:

1. Operational
   The system must be accessible from any computer within the university network, from any web browser.
2. Performance
   The system should always be available and accessible and contain all data from graduated and current graduating students.
3. Security
   Access is limited to the administration staff and head of department while only the head of department has access to change grade composition.

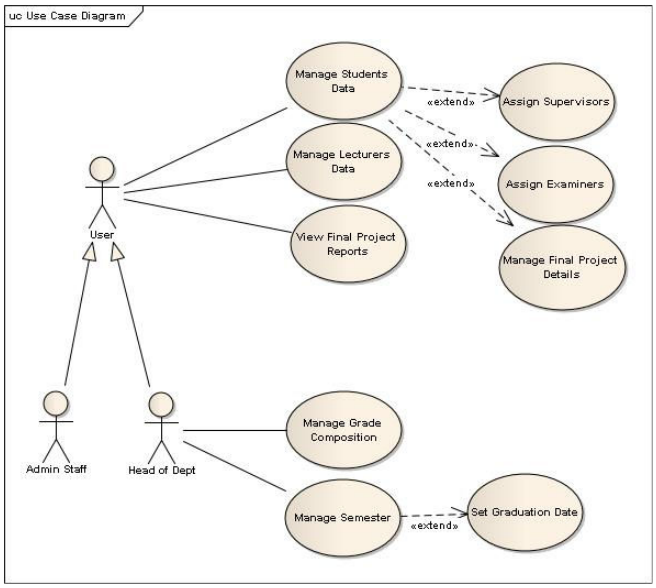

Figure 3. Use Case Diagram of Grade Management System

Functional Modeling

Based on the requirements, the functionality of the system and its interaction with users are modeled using UML, specifically use case diagram and activity diagram as depicted in figure 3 and figure 4 respectively.
As can be seen, the two graduating tracks can be handled simultaneously by the system and any changes to the grading system that may affect students can be directly applied by the head of department through the system. The administration staff will have direct access to students' progress status and data.

4. RESULT AND DISCUSSION

After functional modeling of the system, the database supporting the system is designed accordingly (figure 5). Then the interface of the system is developed according to the principles mentioned above and with the aim of

minimizing user's learning curve since the target user of the proposed system may not possess advanced computer skill.

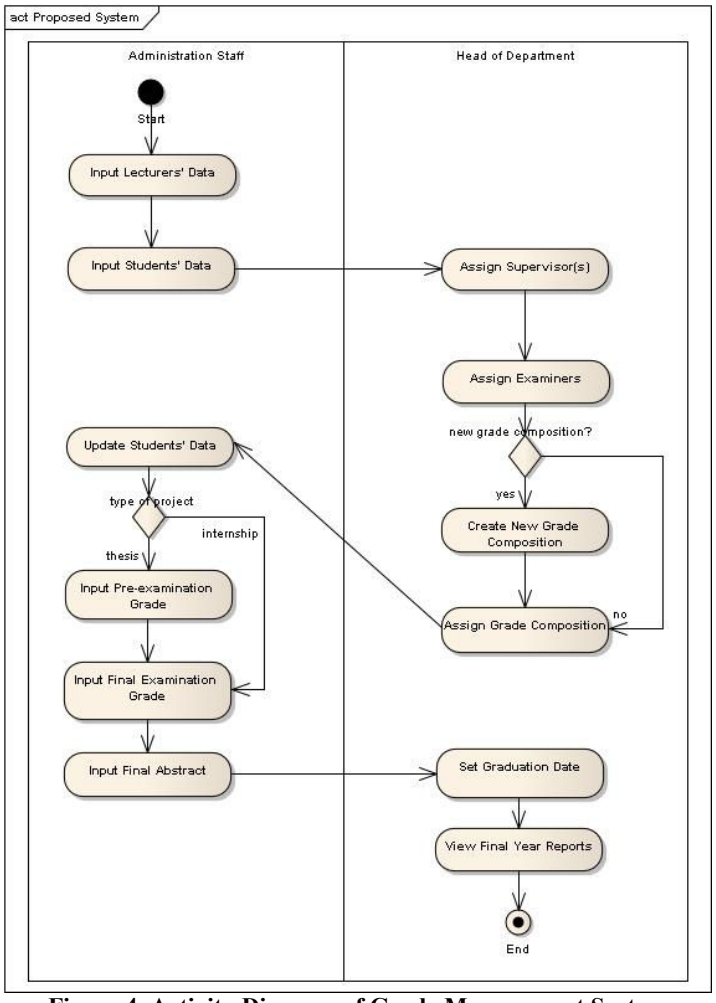

Figure 4. Activity Diagram of Grade Management System

Therefore, the layout of the form pages will resemble the layout paper forms as much as possible to familiarize user. The portability of the design was tested by opening the website using Internet Explorer 7, Firefox and Google Chrome browsers. Due to the minimalist design of the interface, the system is accessible through low bandwidth connection. The menu and layout of the menu are always visible on the top of the screen, as can be seen in the screenshots below. Thus consistency and smooth transition are accommodated.

The information or content needed by the users can be found when the mouse pointer hovers over the menu and expands the submenus. The color contrast of currently selected submenu and the weight of the menu font provide clear presentation of the information. A similar yet stronger emphasis is used to indicate the title of the page the user's currently viewing (bold and large-sized colored font). This will also reduce short-term memory load as users do not have to remember where they are that time. Consequently, the submenus also simplify the layers of navigation of the website, providing the users direct access to the forms or pages they need without having to go through other pages first.

All data that the user inputs are editable or reversible, except when the grades are inserted and the graduation date has passed. This will give users a sense of relief, knowing it is alright to make errors and that they are in control of the system. The system also provides user with information when the data that have been updated are being stored or when the process is being executed. Users will be notified when the process is done and be returned to the first page where they can proceed with other actions or exit the system; thus offering closure, feedback, simple error prevention and easy reversal of actions.

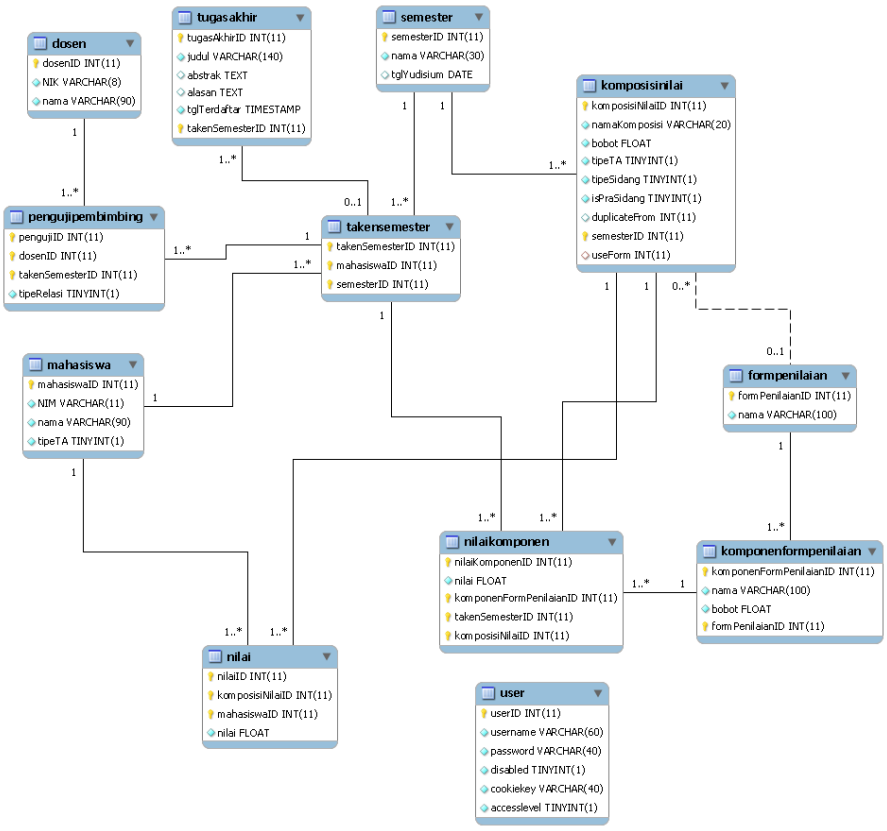

Figure 5. Entity Relational Diagram

Screenshots of several main features of the system can be found below:

1. Main menu
   Figure 6 to 12 are screenshots of the display of the home page (after login) along with the main menu and submenus of each item in the main menu.

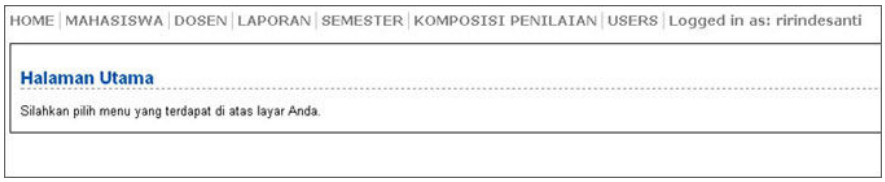

Figure 6. Main Menu

2. Manage students details
   One of the core functions of the system is managing students' detail. Besides adding new students, setting their final project type and the semester they will be conducting their research/internship, the system is also able to edit details of the student regarding their final year project. As shown in figure 13 and 14, for each student the user can use the system to add and view each student's project title, update the status of the project (i.e. when project is extended to the next semester), assign supervisors and examiners and also input final grades for the student.

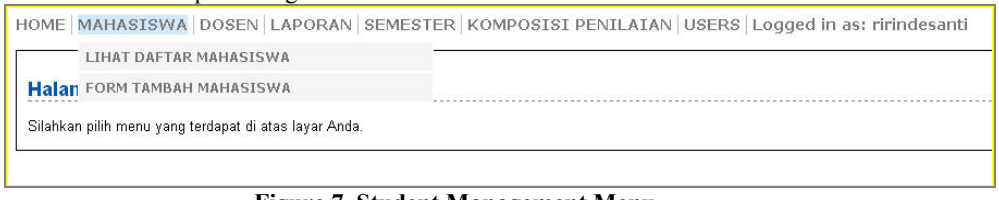

Figure 7. Student Management Menu

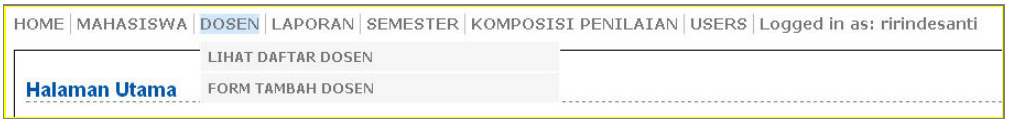

Figure 8. Lecturer Management Menu

Figure 9. Reports Menu

Figure 10. Semester Management Menu

Figure 11. Grade Composition Management Menu

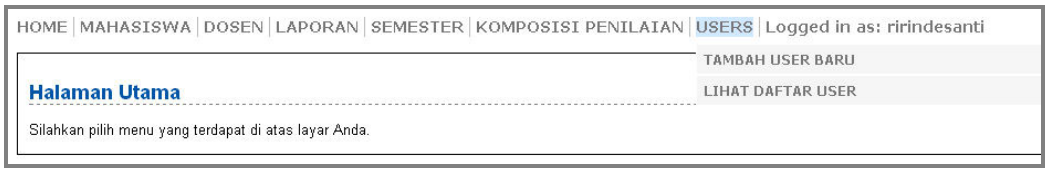

Figure 12. User Management Menu

3. Manage grading schemas
   To assign proper grading schema to each supervisor and examiner, user must access the Manage Grade Composition menu (as shown in figure 15). For each examiner or supervisor, a grade composition from an existing format can be chosen and assigned therefore eliminating the need to create a new form each time one person's composition is changed (i.e. the grading forms are independent from each other).

   The detailed grade composition for each examiner can also be edited and changed within the form (figure 16).

4. Reports
   An example of a generated report can be found in figure 17.

5. CONCLUSION

By utilizing web technology and DBMS, a system to manage Information Systems students' final year grade is built and will be implemented in the department of Information Systems. This system will assist the administration staff in storing and managing data and is also capable of generating reports and overviews needed by the department head.

The learning curve of the user is minimized by using a simple interface design and a layout which resembles the existing paper forms used in the current workflow. User training will also be given to help introduce users to the system and to be able to use it.

Figure 13. Manage Student Details

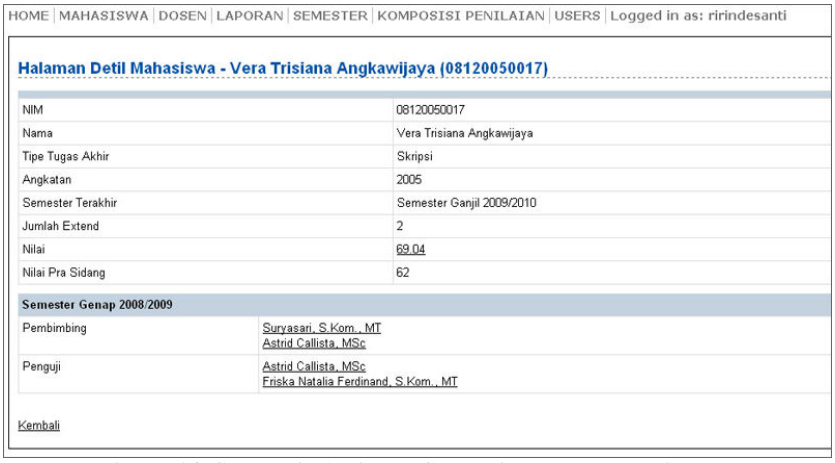

Figure 14. Student's Assigned Supervisors and Examiners

Figure 15. Managing and Assigning Grading Composition

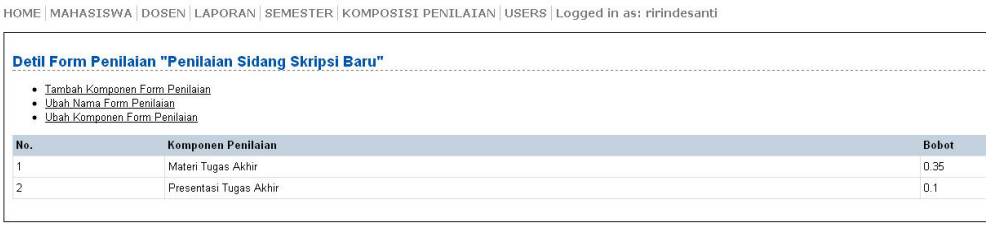

Figure 16. Manage Detailed Grade Composition

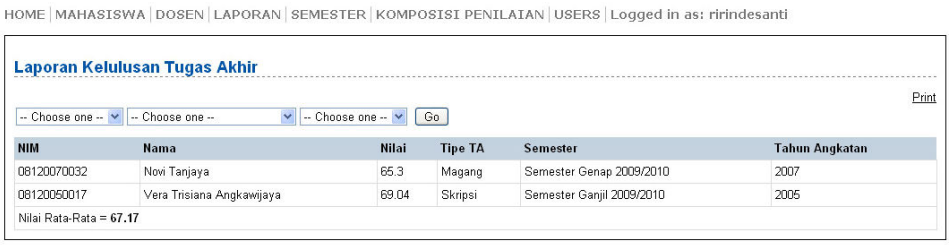

Figure 17. Final Grade Overview Report

Although the proposed system is sufficient to assist both the administration staff and the department head in managing students' final year grade, further development of the system may include features that can give users access to students' transcripts and academic records, thereby expanding the scope of the system by linking it to the university's database. If such a link is established, users for the system will include thesis/internship supervisors and academic supervisor who will be able to monitor students' academic progress and passed subjects which may assist them in supervising and guiding the students during their final year project.

However, security is a very crucial issue that must first be greatly considered and firmly implemented to prevent hacking of grades.

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