Analysis and Design of Student Guidance Information System through Software Development Life Cycle (SDLC) and Waterfall Model

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Abstract

Universities play an essential role in encouraging digital literacy as a form of support to accelerate digital transformation in Indonesia. One of the strategic steps to support the acceleration of digital transformation is to carry out organizational change in the academic scope. One of the innovative ideas to facilitate the thesis registration process, selection of supervisors, and thesis consultation is the existence of an integrated and accountable control system. This research proposes an idea to analyze and design the Information System for Thesis Consultation Process known as SIBIMA using the Software Life Cycle Development (SDLC) method according to the Waterfall model. SIBIMA is intended to support services in the education sector by adjusting the context of the values of the Atma Jaya Catholic University of Indonesia, namely *Kristiani, Unggul, Peduli, and Profesional*. Thus, students, lecturers, and academic staff complement each other in improving the quality of education. The case study of application design is adjusted to the registration process, selection of supervisors, and thesis consultation at the Head of Tourism Department, Faculty of Business Administration and Communication Sciences, Atma Jaya Catholic University of Indonesia.

Keywords: Information, System, SIBIMA, SDLC, Waterfall

1. INTRODUCTION

The Covid-19 pandemic has triggered the growth of information technology users in various aspects, including the education sector. [1] shows that the use of information technology during the Covid-19 pandemic has increased, with the existence of Work From Home (WFH) internet connections and digital devices determining employee performance. On the other hand, [2] shows that during the Covid-19 pandemic in Indonesia, the education sector must adapt to the learning process from offline to online. This indicates that the education sector is one of the triggers for improving information technology with the encouragement of the

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use of online learning media. Thus, the education sector during the Covid-19 pandemic has a vital role in accelerating digital transformation in Indonesia.

One form of digital transformation in the education sector is by accommodating the entire process of conventional data collection and learning to digital with the support of hardware and software, as well as communication network infrastructure and the internet. [3] shows that the development of *e-learning* in universities has opened up opportunities for all parties to study courses of interest online through website-based applications. On the other hand, [4] shows that the development of digital applications for student learning media has facilitated the learning process at the college level. This indicates that the University is vital in driving livelihood change through digital literacy that improves Human Resources (HR) capabilities. Thus, digital transformation at the tertiary level can increase the capacity of human resources to adapt to the development of digital applications in each sector.

Specifically, to improve the quality of educational services, the flow of the consultation process and student thesis guidance must be designed with technological developments in mind. [5] shows that the result of an online tutoring system is beneficial for students to track their research progress and arrange a schedule for guidance with lecturers. On the side of lain, [6] shows that the thesis guidance system can also be developed by providing decision-making features in determining supervisors by qualifications and research topics. Creating a thesis guidance system benefits students, lecturers, and study programs. Thus, this research will analyze and design information systems for student guidance and consultation with lecturers based on the flow in the Tourism study program at the Faculty of Business Administration and Communication Sciences, Atma Jaya Catholic University of Indonesia.

This study aims to analyze and design the Information System for Thesis Consultation Process (SIBIMA) to solve practical problems faced by lecturers, students, the head of the department, and department secretaries. The initiation of SIBIMA design is driven by the results of identifying practical issues faced by all actors regarding the process of selecting supervisors with qualifications by the research topic, recording the history of lecturer-student guidance, student roundness and study period, as well as student databases with thesis status that can be categorized according to specialization and entry batch. Based on the results of identifying practical problems of prospective system users, SIBIMA is designed to facilitate the control function through a monitoring system for the registration process, selection of supervisors, and website-based thesis consultation. Thus, digital applications developed at the study program level can answer the challenges of digital transformation in the scope of faculties and universities.

The case study of designing the SIBIMA application is tailored to the needs of the Tourism Department, Faculty of Business Administration and Communication

(FIABIKOM), Atma Jaya Catholic University of Indonesia. In the thesis guidance process for the Tourism Study program, students need to be monitored using SIBIMA, so students can arrange consultation schedules with supervisors periodically and progressively. Some of the obstacles experienced by educators as supervisors are as follows: first, educators cannot follow the development of the thesis revision results if it is not carried out periodically; second, the consultation process, without clear recordings or notes, has the potential to hinder the development of thesis writing of guidance participants; Third, the main focus of educators is to organize the Tri-Dharma of Higher Education (teaching, researching and serving) so that they have the potential to be negligent in handling the number of guidance participants in large numbers with different class backgrounds.

Students in the thesis consultation process face several obstacles are as follows: first, students need to adjust the schedule of lecturers as thesis supervisors; second, students have their interests (personal and family affairs) in addition to working on the thesis so that personal matters have the potential to hinder the thesis completion process, through changing schedules; third, students are often negligent in recording comments and feedback supervisor, so a system is needed that records the consultation process. Considering the challenges in the consultation process for student thesis guidance, this community service program seeks to design an Information System for the Thesis Consultation Process known as SIBIMA in the form of a website-based application to optimize the registration process, selection of supervisors and thesis consultation.

2. METHODS

This research method is adapted to the main output and additional outputs. However, in general, this research process can be categorized into five stages as follows: first, the pre-research stage; second, the data retrieval stage; third, the stage of data processing; fourth, the application design stage; Fifth, the step of analysis and reporting. Each of the stages of research can be described as follows.
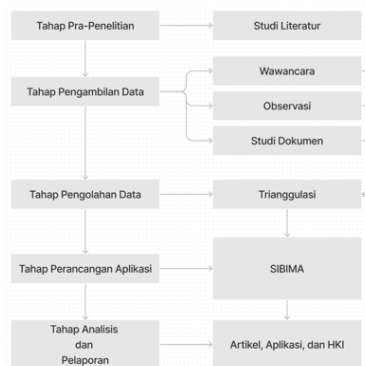

Figure 1. Research Process

Figure 1 is a research flow that is divided into five stages. In the pre-research stage, a literature study is needed to obtain an overview of scriptwriting from the design of website-based applications in the education sector. Furthermore, the data collection stage adopts in-depth interview techniques by involving students, lecturers, study program heads, and secretaries to identify needs and challenges in the registration process, selection of supervisors, and thesis consultation. Observation is done to observe part of the consultation process that can be facilitated online and offline. Meanwhile, document studies are needed to adjust the flow of registration, selection of supervisors, and consultations by the rules applicable to study programs, faculties, and universities. After identifying the obstacles faced, it can proceed to the data processing stage. Triangulation techniques are used in the data processing process to obtain valid and credible information, making it easier to prepare a Business Requirement Document (BRD) from SIBIMA. User Interface and Database design in use case diagrams and Entity Relationship Diagrams (ERD) will be documented to obtain Intellectual Property Rights certificates. The following is a waterfall model in the creation of SIBIMA.
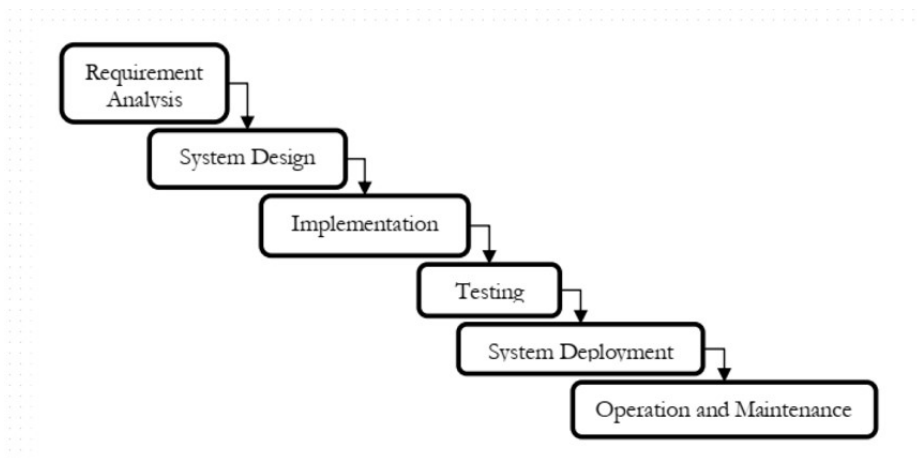

Figure 2. Waterfall Model to Design SIBIMA

The design of SIBIMA in this study will follow the flow of the Software Development Life Cycle (SLDC), especially the waterfall model. [7] shows that the waterfall model has the following stages: first, the analysis of the needs of system users; second, system and software design; third, implementation and unit testing; fourth, system integration and testing; fifth, the operation and maintenance of the system. On the other hand, [8] shows that the requirement analysis stage in the waterfall model can be done by adopting in-depth interviews, observations, and document studies techniques to obtain a comprehensive picture of the needs of system users. This suggests that system designers can retrieve data through in-depth interview techniques, observation, and document studies and then triangulate to validate user needs. Thus, the waterfall model is used to identify user needs in designing SIBIMA as a website-based application.

The Requirement Analysis process is crucial in designing the system to suit users' needs. Therefore, the survey approach is used to identify users' needs (students, lecturers, heads of the department, and department secretaries). The things placed in the survey for student profiles are student names, emails, entry batches, specialization, thesis registration year, first supervisor, second supervisor, and thesis title. Meanwhile, the questions asked are related to the thesis registration process, the thesis guidance process, and the assessment of the SIBIMA application prototype. Based on the survey results, it can be seen that students agree and strongly agree that the thesis registration process can be accommodated through digital platforms. In addition, students agree and strongly agree if the information about thesis topics popularly studied by the previous batch is available. Meanwhile, students agree and strongly agree if there is information about the lecturer's scientific publication history before determining the thesis supervisor. Considering the results of identifying the needs of system users within the SDLC framework, innovative solutions in the SIBIMA system flow become essential.

After the SIBIMA prototype design process, the coding process is carried out according to the design results. Meanwhile, trials were carried out since the prototype was completed through presentations of potential system users to identify obstacles in SIBIMA operational simulations. Suggestions and criticisms from potential system users are collected to fix deficiencies in the system and anticipate critical constraints at the deployment stage. Some of the tips that have been identified are as follows: the display of SIBIMA needs to be facilitated and synchronized with the domain and hosting of the university; SIBIMA's user interface can be adjusted to the appearance of the SEKATA system to facilitate user recognition of system features and functions; SIBIMA needs to be developed a mobile version so that it can be accessed by users using smartphones. They are considering the suggestions and criticisms of SIBIMA, and the system development process is carried out periodically. Thus, the operation and maintenance process no longer emphasizes critical aspects but only the development of features needed by users.

3. RESULTS AND DISCUSSION

Based on the results of the classification of user needs, it can be seen that there are differences in requirements between students, lecturers, study program heads, and study program secretaries. The results of interviews and observations with students show that: students tend to find an idea or clues about the thesis topic, so they need information about the popular topic of the thesis project in the tourism department; Students need partners to share their idea during the thesis project, and they tend to seek several students with the same status (thesis project); Students tend to work in a group based on their specialization in college; Several students tend to select and recommend the supervisor based on likes and dislikes or personal assessment of the lecture personality or behavior, or attitude instead

of publication records; Several students find the supervisor based on skill and specialization in specific topics, and make sure first and second supervisor out of "conflict of interest."

Meanwhile, the results of interviews and observations of lecturers show several system needs: each lecturer needs a preliminary thesis proposal assessment before agreeing to the supervision process; each lecturer has a unique writing style or academic writing standard. The initial thesis proposal assessment will be evaluated to measure and predict the students' capability in the supervision process; each lecturer tries to save the consultation records, but sometimes the documents need to be erased or lost because of human error or hardware issues on the laptop/computer. In addition, the notes of revision might fail because the students paid leave for 1-2 semesters; each lecturer needs information about the student's progress on time due to tasks or modifications in every section; each lecturer puts an effort for the students, to graduate on time based on the study period determined by the department, university, and government.

Next are the results of interviews and observations of the head of the study program, which show that: the head of the department is responsible for monitoring the student's progress during the consultation process; the head of the department is responsible for reporting the student's progress in the meeting; the head of the department needs to evaluate the thesis consultation with all supervisors to identify challenges and constraints, and also solve the problem by coordinating the issue with the dean of faculty; the head of the department is responsible for reporting the thesis consultation result annually with the vice-rector, to evaluate the student's learning and experience in the university; the head of the department is responsible for describing the thesis consultation process to the accessor during the accreditation assessment process.

The results of interviews and observations of the secretary of the study program showed that: the department secretary monitors the database of students' documents; the department secretary is responsible for reminding all students to complete the personal data on the system for documentation; the department secretary is responsible for announcing and guiding all the students to follow the procedure and flow of the thesis registration process; the department secretary is responsible for reporting all the challenges and constraints to the head of the department; the department secretary is responsible for preparing all the data requested by the head of the department and supporting the document required in the meeting or accreditation assessment process. Based on the results of interviews and observations with actors as users of the system, the SIBIMA use case is designed based on the existing conditions and context of the Tourism study program, at the Faculty of Business Administration and Communication, Atma Jaya Catholic University of Indonesia, as the figure below.
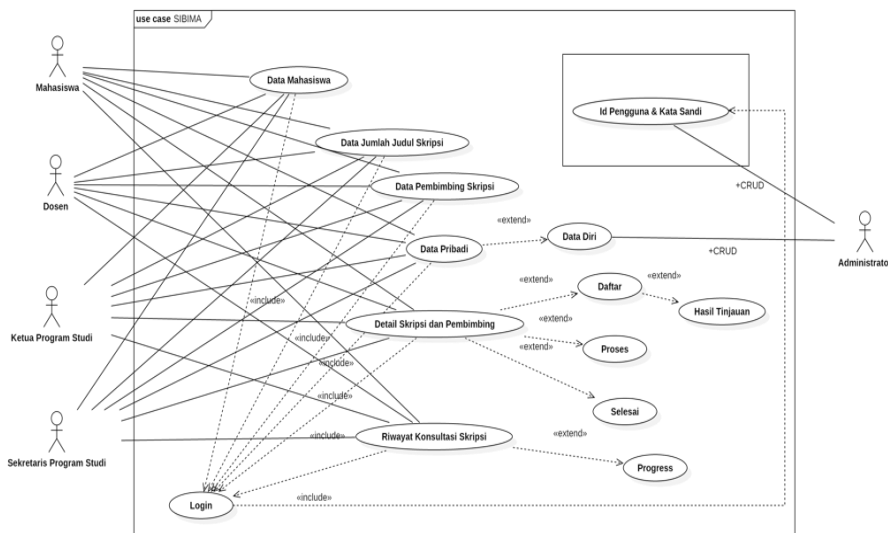
Figure 3. Use Case of SIBIMA

Figure 3 is a SIBIMA use case designed for each actor based on several questions according to the user classification. For users as students, the questions used as a reference for flow and function design in use cases are: How to optimize the flow and design the popular topic based on the previous thesis project through Word Cloud?; How to optimize the flow and create the existing number of students in the department with "thesis" status (Draft, Process, Finished)?; How to optimize the flow and organize the data of all students with thesis status in the department based on the specialization?; How to optimize the flow and create the information or the list of supervisors in the tourism department?; How to optimize the flow and design the publication record of the lecturer in the tourism department? This shows that users as students need access to student data, data on the number of thesis titles, thesis supervisor data, and personal data. In addition, students need access to the page to monitor the progress of the guidance process, from registration and guidance to getting recommendations for thesis exams.

Furthermore, the results of the conversion of existing data from the effects of interviews and observations of lecturers, some of the questions that are used as references to design a SIBIMA use case for users as lecturers are as follows: how to optimize the flow, and create the registration and selection process for lecturers based on the research topic and design?; how to optimize the flow and visualization of the system to provide detailed information about the thesis proposal document from sections 1-3 and references uploaded by students?; how to optimize the flow and visualization of the system for student-supervisor interaction and notes recording during the consultation process from sections 1-

6?; how to optimize the flow and visualization of the design for the recommendation process when the students complete the supervision process; how to track the progress of the students during the thesis consultation process?. Based on this question, it can be known that lecturers need access to all student data, data on the number of thesis titles, thesis supervisor data, personal data, thesis and supervisor details, and thesis consultation history. Users of the system as lecturers have the right to review documents in the form of thesis proposals submitted by students and reject or approve the proposals to proceed to the following process.

The questions that become a reference for designing the flow of the head of the study program are as follows: how to optimize the flow and create the visualization of all student's data based on entry year, specialization, and thesis status (draft, process, finished)?; how to optimize the flow and design the visualization of the popular topic through a word cloud?; how to optimize the flow and create the visualization of the web page to track the progress of the thesis consultation process based on entry year, specialization, thesis status, and supervisor?; how to optimize the flow and design the web page visualization to add, update, and delete the supervisor data in the database?; how to optimize the flow and create the web page visualization to select and download all the data during the evaluation or accreditation assessment process?. Based on this question, the access and authority of the head of the study program are to add, update and delete the data of lecturers as supervisors. For the rest, the head of the study program can access all data just like the lecturer. The consideration for creating the flow of the director of the study program is the ease of accessing the data needed in monitoring the length of student studies, including in the process of working on a thesis, as well as preparing the documents required during the visitation process for re-accreditation of the study program.

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Login Page

Landing Page

Data of Thesis Applied

Data of Supervisor

Figure 4. User Interface of SIBIMA

Figure 4 shows that the general data needed by each actor is data on the number of students who have registered a thesis that can be traced based on the background of the entrance force and specialization. Furthermore, each actor can access data related to the number of students in each batch based on the status of the thesis (list, process, completed). Each actor can also see the distribution of the number of mentors based on the classification of the supervisor's name and the status of the supervisor, both the first and second supervisors. This shows that SIBIMA is designed to meet the needs of students to optimize the thesis consultation process until it is completed on time. Meanwhile, lecturers can use SIBIMA to document revision records based on uploaded documents without fraudulent behavior. Likewise, the head of the study program can download all student data based on the need for evaluation meetings at the study program, faculty, and university levels. Meanwhile, the head of the study program can monitor and utilize SIBIMA to facilitate the assessment process when accrediting.

SIBIMA's design is adapted to the organizational culture within the scope of the Tourism study program, Faculty of Business Administration and Communication, Atma Jaya Catholic University of Indonesia. To achieve superior accreditation, the university encourages study programs to take policies that support education management. In responding to procedures at a high level, one of the efforts to optimize the registration process, and the implementation of thesis guidance, an information system that documents all activities is needed. SIBIMA is designed to maximize education management in a limited scope, namely the thesis

consultation process. However, SIBIMA will be developed periodically to support the educational administrative function. Thus, SIBIMA becomes the initial strategy for generating study programs by adjusting the needs of students, lecturers, heads of study programs, and secretaries of study programs.

3. CONCLUSION

The analysis and design of the Information System for the Thesis Consultation Process, known as SIBIMA, can accommodate the interests of each actor, student, lecturer, head of the tourism department, and a department secretary. Each actor has a flow and function that complements each other and is designed to minimize the potential for fraud and human error that hinders the student study process. SIBIMA is intended to support services in the education sector by adjusting the context of the values of the Atma Jaya Catholic University of Indonesia, namely *Kristiani, Unggul, Peduli, and Profesional.* Thus, students, lecturers, and academic staff complement each other in improving the quality of education in the Faculty of Business Administration and Communication Sciences tourism study program.

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