Implementation of User Acceptance Tests in Capstone Project Information Systems: Case Studies from Electrical Engineering Study Program of Udayana University

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Abstract The Capstone Project Information System (SICP) was developed to manage the administration of capstone projects in the Electrical Engineering Study Program at Udayana University, aiming to minimize repetitive tasks and reduce the potential for human error. Testing was conducted using the User Acceptance Testing (UAT) method to ensure the system meets the needs and expectations of end users. UAT involved various user roles and utilized the Likert scale for evaluation. The test results indicate that the system operates according to functional specifications, and users are satisfied with the interface and functionality. The overall UAT score of 0.939 shows that SICP has successfully met user needs very well. This testing ensures that SICP is ready for use and contributes to the accreditation achievement from the Indonesia Accreditation Board for Engineering Education (IABEE).

Keywords— Information System, Capstone Project, Testing, User Acceptance Test (UAT)

I. INTRODUCTION

In an increasingly advanced digital age, the development of information systems is essential to support a wide range of activities in various fields, including higher education. Software testing is a crucial stage in the software development cycle to ensure that systems are built according to specifications and free of errors. One of the most used test methods is User Acceptance Testing (UAT), where the focus of this test is validation by end users to ensure the system meets their needs and expectations.

Capstone Project Information System (SICP) is an information system packaged in one module that can be integrated into SIMAK and used to help manage CP activities at PSTE Unud based on the website. The CP activities consist of proposal seminars, results seminars, and final exams. There are six types of user access, namely students, lecturers, CP coordinators, study program coordinators, PSTE Unud correspondence admins, and SIMAK PSTE Unud admins.

The Capstone Project Information System Project (SICP) was developed to deal with administrative processes related to the capstone project in the Electrical Engineering Studies Program at Udayana University. According to the 2023 capstone project guidelines, capstone projects are final projects carried out by a group of students, in which students apply their knowledge and skills through engineering design processes to demonstrate their practical abilities.

The Capstone Project is implemented to obtain accreditation from the Indonesia Accreditation Board for Engineering Education (IABEE), a non-profit organization responsible for quality assurance of international level engineering and computing education [1].

To ensure that the SICP works properly in dealing with the administration of the capstone project at PSTE Unud, UAT tests are carried out. These tests are aimed at ensuring that the system can meet the needs and expectations of end users, so that it can operate effectively and efficiently, as well as support the implementation of capstone projects that contribute to achieving IABEE accreditation.

II. LITERATURE REVIEW

A. UAT (User Acceptance Test)

User Acceptance Test (UAT) is a testing method between end users and systems that is useful for verifying whether a

feature is running according to user needs. UAT is one of the final testing series of software and is carried out before development and deployment [2]. UAT in this project was carried out using a questionnaire. During UAT, the user is the one who actually tests the application to ensure that the application can handle the tasks required and is in accordance with the specifications.
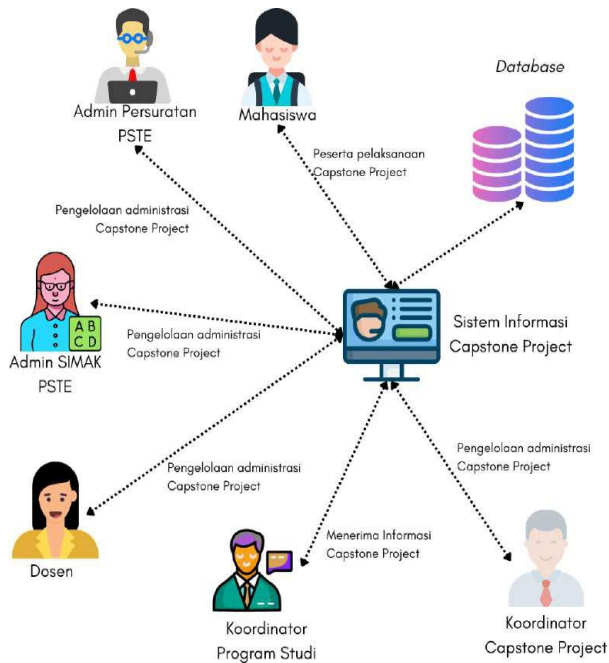

Fig. 1 System Overview

A questionnaire is a data collection technique by providing several questions to be filled in by respondents. A good questionnaire also contains good questions. The list of questions on the questionnaire must be clear and easy to understand so as to reduce respondent errors when filling out the questionnaire.

UAT technique is the final test before the system is used by the user which involves testing with system user data. UAT is a software acceptance test carried out at the user's place by the user of the software. The purpose of this test is to test whether the system is in accordance with what is stated in the system's functional specifications (validation). The calculation is done using a Likert scale. The Likert scale is an assessment scale that presents a choice of scales with values on each scale to measure the level of agreement with something. The Likert scale is used to measure the attitudes, opinions, and perceptions of a person or group about events or social symptoms where each question has a value weight.

When trying to assess the extent to which users of an information system are satisfied, questionnaires are often used as a data collection tool. However, questionnaires have the potential to produce unreliable information. To overcome this problem, the Likert Scale method is widely used. The

Likert Scale is a tool that allows for measuring the views, opinions, and perceptions of individuals or groups on a particular topic or problem. The questionnaire approach with the Likert Scale aims to ensure that the data obtained is accurate and has been tested for the truth.

In Capstone Project Information System (SICP) development, the use of User Acceptance Testing (UAT) has several important reasons. First, SICP involves various features and modules that are developed to meet needs. By conducting UAT, users can directly test new features and functionality that have been implemented, ensuring that each stage of development produces results that are in accordance with expectations.

Second, UAT allows early detection of potential problems or errors in development. Users have the opportunity to provide direct feedback on system performance, user interfaces, and other functionality. This allows the development team to quickly respond to user feedback and make any necessary improvements or adjustments.

Third, by involving users, UAT helps ensure that SICP consistently meets user expectations and needs. This minimizes the risk of gaps between user expectations and the results produced by system development. UAT also provides an opportunity to adjust development priorities and focus based on actual user feedback.

Fourth, implementing UAT can improve transparency and communication between the development team and users. This ensures that users have a better understanding of development progress and provides better insight into how the system will function when fully implemented.

Fifth, using UAT can help SICP avoid significant buildup of issues late in development. Errors or issues that are regularly detected and addressed can reduce the complexity and risk of errors in the final testing and implementation stages. For these reasons in combination, using UAT in SICP development helps ensure that system development meets expectations, improves the quality of the final product, and provides optimal user satisfaction.
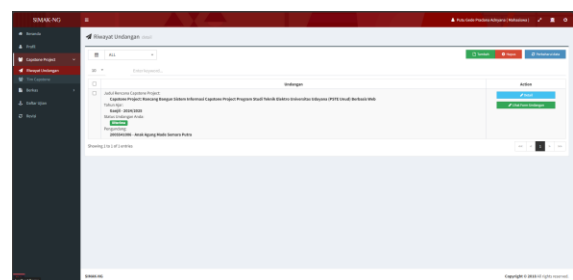

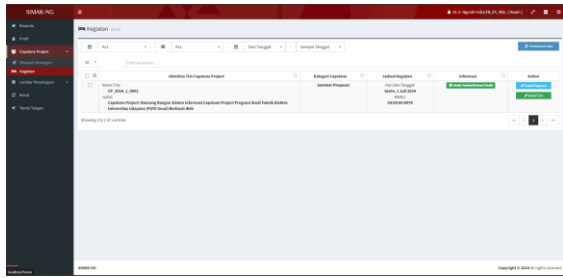*Fig. 2 Menu Display on the Student Role*
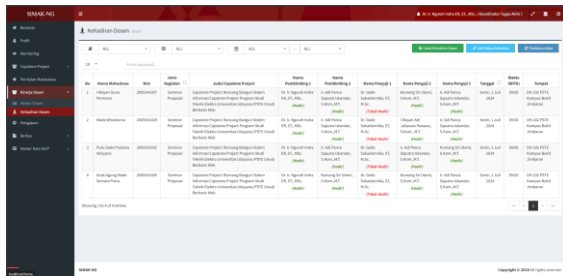
Fig. 3 Menu Display on the Lecturer Role

Fig. 4 Menu Display on the Capstone Project Coordinator
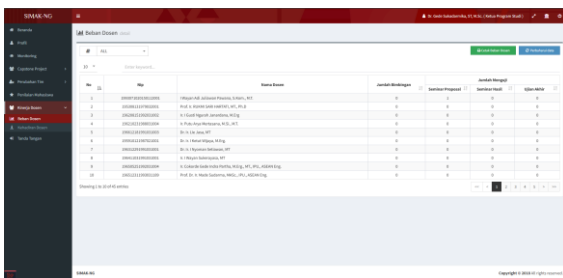
Role
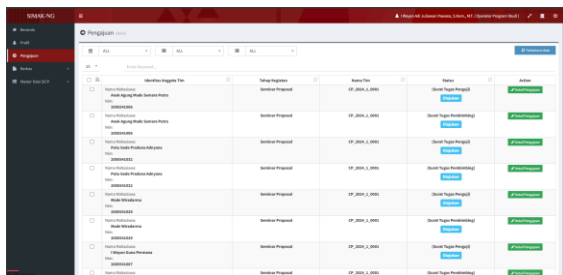

Fig. 5 Menu Display on the Study Program Coordinator

Role

Fig. 6 Menu Display on the Study Program Operator Role

Fig. 7 Documentation of User Acceptance Test

III. METHOD

User Acceptance Testing (UAT) is the last stage of testing before a system is used by a user, which involves testing with data from a system user. UAT is a test method involving end users and systems to verify whether a feature already works according to the user's needs. UAT is part of the final testing of the software, carried out before the development and implementation phase [3]. The UAT assessment is done using the Likert scale, which is a scale of assessment with several choice values to measure the degree of agreement with a thing. The Likert Scale is used to assess the attitude, opinion, and perception of a person or group to a social event or phenomenon, where each question has a specific value [4].

In UAT, each role is tested by demonstrating the system to the respondent according to its role, then proceeding with the completion of a questionnaire to assess aspects of functionality, software engineering, and visual communication design. Each aspect is assessed using the likert scale with a scale:

1. Very Agree (5),
2. Agree (4),
3. Enough (3),
4. Disagree (2)
5. Very Disagreed (1).

A. Calculate the percentage of each question element

In equation (1), the total weight obtained for each question is divided by the ideal value.

$$P_{qi} = \frac{S_{qi}}{S_{ideal}} \tag{1}$$

Where:

S_{qi} = total weight of each question

$S_{ideal} = Scale_{max} \; x \; n_{respondent}$

B. Calculates the average percentage of each aspect

In equation (2), the average of the percentages of each query in one aspect is calculated by dividing the total number of percents of the query by the number of queries.

$$P_{aspect} = \frac{1}{n_q} \sum_{n=1}^{n_q} P_{qn} \qquad (2)$$

C. Calculating the average percentage of each role

In equation (3), the average percent for each aspect is calculated by summing up all percentages of the aspect and dividing them by the number of aspects.

$$P_{role} = \frac{1}{n_{aspek}} \sum_{n=1}^{n_{aspek}} P_{aspek_n} \qquad (3)$$

D. Calculates the average percentage of the entire system

In equation (4), the average of the percentages of each role is calculated by adding all percentage values of the role and dividing them by the number of roles.

$$P_{total} = \frac{1}{n_{role}} \sum_{n=1}^{n_{role}} P_{role_n} \qquad (4)$$

By following some of the calculations above, it is possible to determine the average value of the percentage of each aspect, each role, and the overall average of the developed system.

IV. RESULT

User acceptance testing (UAT) has been conducted with several roles involved in the system using an online form called Google Form. The calculation begins with analyzing all the data stored in Google Spreadsheet and Google Colaboratory. Additionally, we use several Python libraries, such as pandas, numpy, matplotlib, and seaborn, to extend our analysis.

The **Error! Reference source not found.** illustrates the percentage comparison of various aspects across different roles: Student, Lecturer, Capstone Project Coordinator, Study Program Operator, and Study Program Coordinator. The aspects assessed include Functional Aspects, Aspects of Software Engineering, and Aspects of Visual Communication Design. Additionally, the overall percentage for each role is presented. Students rated Functional Aspects at 82%, Aspects of Software Engineering at 88%, and Aspects of Visual Communication Design at 88%, with a total score of 86%. Lecturers uniformly rated all aspects at 92%, resulting in a total score of 92%. Capstone Project Coordinators gave all aspects a score of 100%, yielding a total score of 100%. Study Program Operators scored 88% for Functional Aspects, 100% for Aspects of Software Engineering, and 97% for Aspects of Visual Communication Design, with a total score of 95%. Study Program Coordinators rated Functional Aspects at 100%, Aspects of Software Engineering at 93%, and Aspects of Visual

Communication Design at 97%, leading to a total score of 97%.

Then the calculation is done to determine the average value of the percentage of the entire tested system as in the formula below.

$$P_{total} = \frac{0,861 + 0,920 + 1 + 0,949 + 0,966}{5} = \mathbf{0,939}$$

From the above calculations, the average percentage value of the system is 0.939, where this percentages indicate that the built system already meets the needs and the expectations of the user with a value of 93.9%.

TABLE I
FUNCTIONAL ASPECTS OF THE STUDENT ROLE

Question Code	Question
Function_1	Can log in properly, and information regarding whether the login was successful is clear
Function_2	Can view the profile properly and there are no errors in updating the profile
Function_3	Can send invitations to students and lecturers, receive invitations as a student sent by other students and can accept or reject invitations properly
Function_4	Can submit the activity requirement files properly
Function_5	Can submit registration for activities at each stage
Function_6	Can view information on the implementation of previously registered activities
Function_7	Students can view the revisions properly and submit the revised reports
Function_8	Students can submit final files properly

TABLE II
FUNCTIONAL ASPECTS OF THE LECTURER ROLE

Question Code	Question
Function_1	Can log in properly, and information regarding whether the login was successful is clear
Function_2	Can view the profile properly and there are no errors in updating the profile
Function_3	Can accept invitations as a supervisor sent by students and can accept or reject invitations well
Function_4	Lecturers can receive and see information on the implementation of activities carried out by students properly and clearly
Function_5	Lecturers can digitally sign files and enter a signature PIN without any problems
Function_6	Lecturers can receive reports that have been revised by students and can provide comments on what students need to revise properly

TABLE III
FUNCTIONAL ASPECTS OF THE CAPSTONE PROJECT COORDINATOR ROLE

Question Code	Question
Function_1	Can log in properly, and information regarding whether the login was successful is clear
Function_2	Can view the profile properly and there are no errors in updating the profile
Function_3	Can send invitations to students and lecturers, receive invitations as a student sent by other students and can accept or reject invitations properly
Function_4	Can submit the activity requirement files properly
Function_5	Can submit registration for activities at each stage
Function_6	Can view information on the implementation of previously registered activities
Function_7	Students can view the revisions properly and submit the revised reports
Function_8	Students can submit final files properly

TABLE IV
FUNCTIONAL ASPECTS OF THE STUDY PROGRAM OPERATOR ROLE

Question Code	Question
Function_1	Can log in properly, and information regarding whether the login was successful is clear
Function_2	Can view profiles properly and there are no errors in updating profile
Function_3	Get information on submitting a letter of assignment properly and clearly on the system
Function_4	Displaying the final student files properly, can verify the final file smoothly
Function_5	Can see the lecturer's assessment file for students properly and clear

TABLE V
FUNCTIONAL ASPECTS OF THE STUDY PROGRAM COORDINATOR ROLE

Question Code	Question
Function_1	Can log in properly, and information regarding whether the login was successful is clear
Function_2	Can view profiles properly and there are no errors in updating profile
Function_3	The study program coordinator can receive and view information on the implementation of activities carried out by students properly.
Function_4	On the home page, displays information related to the implementation of CP
Function_5	Study program coordinator can input signature and pin into the system

TABLE VI
SOFTWARE ENGINEERING ASPECTS OF THE ALL ROLES

Question Code	Question
SE_1	The interface design of Capstone Project Information System is in accordance with what is needed by users
SE_2	Capstone Project Information System can be easily understood by users
SE_3	Capstone Project Information System runs smoothly
SE_4	The features in Capstone Project Information System have been adjusted to the specified functionality
SE_5	All features in Capstone Project Information System operate well
SE_6	Overall, Capstone Project Information System has met all user needs, both in terms of interface and features provided

TABLE VII
VISUAL COMMUNICATION DESIGN ASPECTS OF THE ALL ROLES

| Question Code	Question
VCD_1	The Capstone Project Information System interface is quite good and provides the clarity required
VCD_2	The sidebar and header menus on Capstone Project Information System are good enough and provide the clarity needed.
VCD_3	The data input form on Capstone Project Information System is quite good and provides clarity as needed.
VCD_4	The alert messages on Capstone Project Information System are quite good and provide the clarity needed
VCD_5	The type and size of the font used is very easy to read
VCD_6	The color combination on the Capstone Project Information System display is quite good and provides the clarity needed.
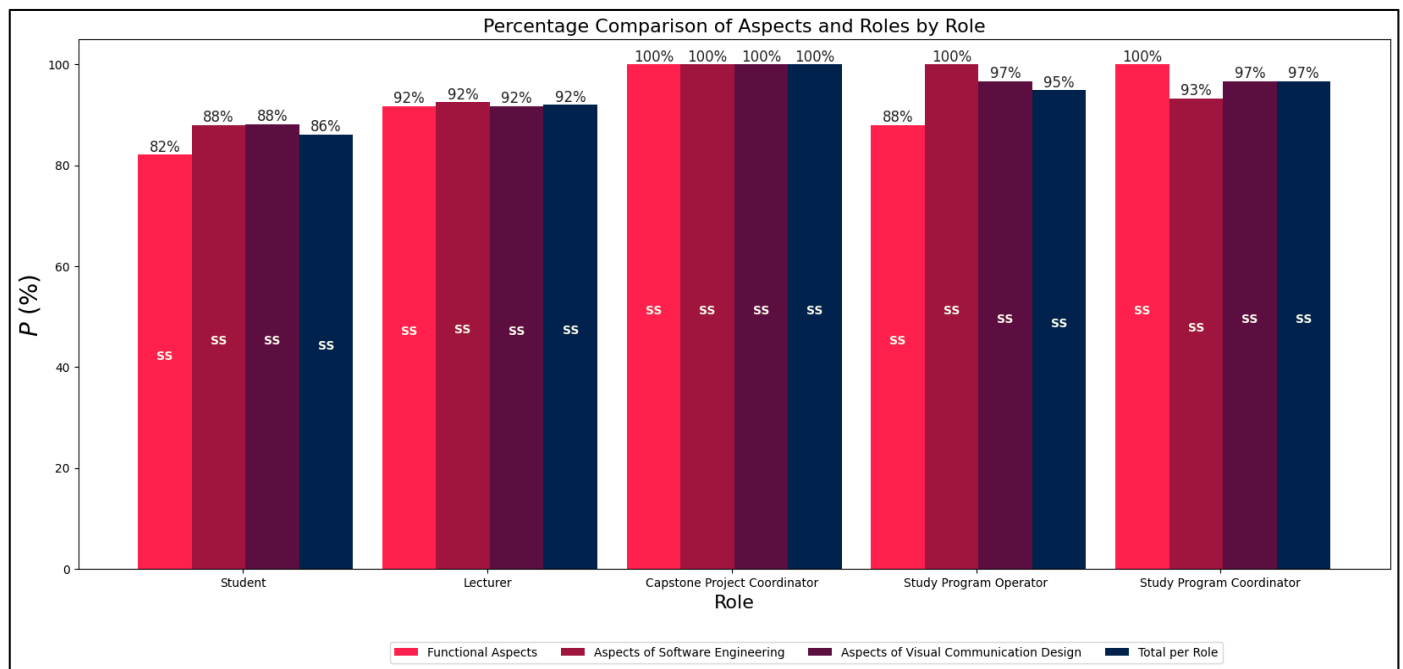
Fig. 8 Percentage Comparison of Aspects and Roles by Role

V. CONCLUSION

Based on the User Acceptance Test (UAT) test results of the Capstone Project Information System, it can be concluded that the system successfully meets the needs and expectations of the end user. Users were satisfied with the interface and functionality provided by the Capstone Project Information System, which has been in line with their wishes. The overall UAT value of 0.939 indicates that users strongly agree that the Capstone Project Information System has met their needs very well.

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