OPEN ACCESS
VOL. 7, NO. 1, PP.089-106, NOVEMBER 2024

ISSN : 2622-8106 (ONLINE)
DOI: 10.20895/INISTA.V7I1.1468

Journal of Informatics, Information System, Software Engineering and Applications (INISTA)

Implementation of Agile Methodology in the Design and Development of Web-Based New Student Admission Information System Case Study: Al-Fath Kindergarten

Dzakiyyah Al Kaazhim *[1], Nicolaus Euclides Wahyu Nugroho [2]

[1] *Information System, Telkom University Purwokerto*
Jl. DI Panjaitan No. 128, Purwokerto, Center Java, Indonesia
[1] dzakiyyahalkaazhim@student.telkomuniversity.ac.id

[2] *Informatics Engineering, Telkom University Purwokerto*
Jl. DI Panjaitan No. 128, Purwokerto, Center Java, Indonesia
[2] nicolausn@telkomuniversity.ac.id

Received on 28-05-2024, revised on 20-11-2024, accepted on 29-11-2024

Abstract

The infrastructure supporting communities and educational institutions is necessary for the Industry 4.0 era to increase the productivity of educational institutions. The new student registration process at TK Al-Fath is still traditional. It has several shortcomings, such as repeated visits by parents during registration, repetitive information delivery, and unorganized documents, leading to difficulties in data summarization. A web-based system is required to assist TK Al-Fath and prospective students' parents in the new student admission process. This information system will be developed using the Agile development methodology, which will include stages of planning, implementation, software testing, documentation, and deployment. By applying the Agile methodology, the developed information system meets user needs and can be quickly adapted according to changes and feedback received during the development process. This system is limited to serving as an information and registration center, developed from observation, discussion, and literature study. In the final stage, Blackbox testing and User Acceptance Testing (UAT) were conducted. In the Blackbox testing, there were nine functionality testing scenarios, all of which resulted in a 'Successful' status after being tested by 20 respondents. The design and development of the Web-Based New Student Admission Information System at TK Al-Fath were completed and accepted by users, with a total UAT percentage of 93.58%, falling into the 'Very Good' category.

Keywords: Agile Development, Information System, Web-Based New Student Admission Information System, Design and Development

Corresponding Author:
*Dzakiyyah Al Kaazhim
Information System, Telkom University Purwokerto
Jl. DI Panjaitan No. 128, Purwokerto, Center Java, Indonesia
Email: dzakiyyahalkaazhim@student.telkomuniversity.ac.id

I. INTRODUCTION

Technology encompasses all tools and infrastructure used to meet human needs and create comfort in daily life [1]. Websites were basic infrastructure in the era of the Industrial Revolution 4.0 [2]. Currently, education and technology are two inseparable factors. Everything has become highly digitized, making it important to have a school website in the digital era [2]. A school website can be used as a means of communication between parents and the school to convey necessary information.

One form of formal education for early childhood is Kindergarten (TK). Kindergarten aims to prepare them for entering elementary school education[3], [4], [5]. Kindergarten (TK) education aims to enhance

children's motor, cognitive, religious, and moral skills. This is intended to ensure that their growth and development can reach their maximum potential and are well-facilitated [6], [7].

TK Al-Fath is a kindergarten that does not charge any fees and is specifically intended for orphans and underprivileged children. Based on an interview with the principal of TK Al-Fath, there is currently no information system for new student admissions at TK Al-Fath. The current registration process starts with conveying information about the opening of new student registration at TK Al-Fath, which is communicated verbally and through flyers. Many parents of prospective new students repeatedly come to the school during registration to inquire about registration information, requiring the school to provide the same information repeatedly.

The business process that has been running so far is felt to be insufficient due to consuming a lot of time. Registration files that are still in hardcopy format result in file accumulation. Storing registration files that are still stacked on the table can lead to damage or loss of files for prospective new students [8], [9].

The administrative staff of TK Al-Fath stated that the current data recording process is time-consuming because student data received by TK Al-Fath needs to be manually typed into Ms. Excel. Manual data transfer can increase the likelihood of data errors. It is hoped that the next data recording process can be made easier by exporting data from the new student admission information system.

Based on the survey results conducted with the parents of TK Al-Fath students, 30 out of 35 parents have previously used the Information System.

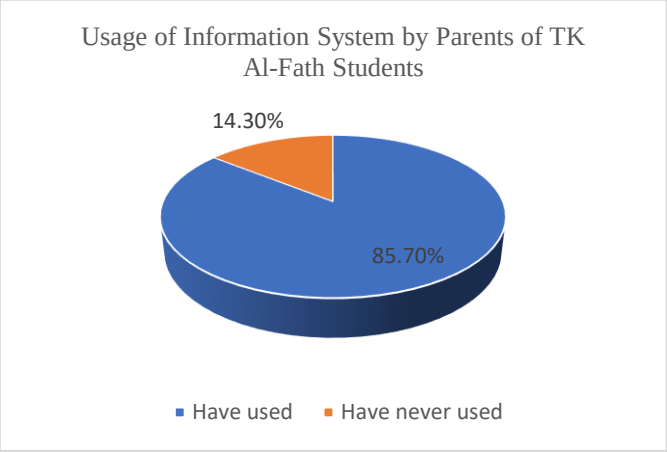

Fig. 1. Total Users of The Information System (Source: Primary Data)

In Figure 1, it shows the percentage of parents of students who have previously used the information system. A total of 85.7% of parents have used the information system before, such as E-Banking/Internet Banking/Mobile Banking, E-Commerce (Shopee, Tokopedia, Lazada, and others), online bookings, online SIM registration, and others. This proves that the majority of parents are familiar with the Information System.

Based on the current issues faced by TK Al-Fath, a web-based new student admission information system is needed to facilitate prospective parents in obtaining information and registering, as well as to ease the dissemination of information and registration data collection for TK Al-Fath. The development of the website for the new student admission information system is carried out using the Agile methodology because, in Agile, software reviews or testing can be conducted before or after development is completed [10], [11] So the results can be seen quickly. Agile is also referred to as an approach to system development that focuses on rapid delivery and allows for changes at any time [12]. The Agile method can quickly adapt to changes in various forms without compromising the quality of the information system [13]. The implementation of the Agile method includes system planning by gathering data from users to understand the desired system requirements. Next, the implementation of building the new student admission information system based on the website is carried out. Once the system is completed, software testing is conducted using the blackbox method, and software documentation is done to facilitate the maintenance process. Finally, deployment is done after the system meets the requirements.

II. RESEARCH METHOD

This research involves two types of data, namely primary data and secondary data. The materials used in this research are obtained from several methods, including:

1. Primary Data

Primary data is obtained from observations, discussions, and Q&A sessions with relevant stakeholders, such as parents of students as well as the Head of School and teachers of TK Al-Fath as the informants. In direct field observations, observations are made on a phenomenon or event at the location of TK Al-Fath. Then, noting and recording what happens, such as observing how parents register, noting the requirements needed by TK Al-Fath, observing the duration of new student registration and the interaction patterns of parents with TK Al-Fath staff, observing the responses of parents to advertisements or registration information explained by TK Al-Fath staff, and noting the situations or environmental factors that affect new student registration, such as the density of applicants, weather conditions, environmental security, and so on. Furthermore, discussions and interviews are conducted with the head of the school and TK Al-Fath teachers, who ask several questions about the business processes that have been carried out, system requirements, and the expectations of the information system to be built. Additionally, primary data is also collected through the use of questionnaires distributed to parents of TK Al-Fath students.

2. Secondary Data

The secondary data for this research was obtained through a literature review by collecting documents, readings, and journals related to the design of a new student admission information system based on websites from previous studies. The following are the stages of designing the new student admission information system using the agile method, as shown in Figure 2.

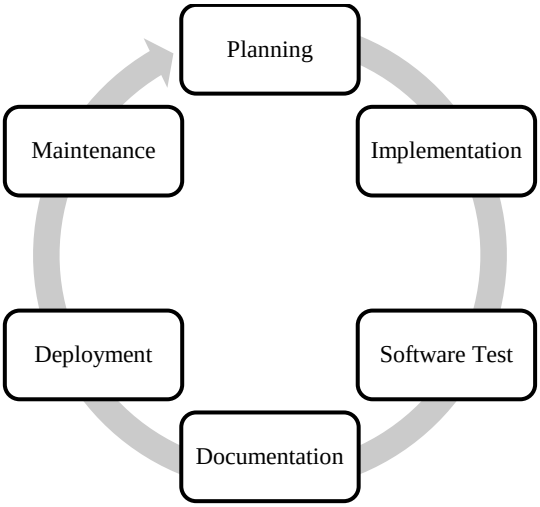

Fig. 2. Agile Development [14]

Figure 2 illustrates the stages of system design using the agile development method. In the design of the new student admission information system, it only reaches the deployment stage. TK Al-Fath carries out the maintenance of the system.

A. Planning

In this stage, system planning is conducted by gathering data from users through observation, direct interviews, and questionnaires. The aim is to gain an understanding of the desired needs of the users. This planning is intended to generate a design concept regarding the requirements of the system to be developed. Next, the Unified Modeling Language (UML) design is carried out based on the system requirements analysis.

B. Implementation

In the implementation stage, software programming is carried out according to the existing design, such as UML Design and User Interface Design. The development of the new student admission information system based on a website is done using the Laravel framework.

C. Software Test

Blackbox testing is a testing method used to ensure that, according to specified functional requirements, all software operates correctly [15].

D. Documentation

After software testing is conducted, the next stage is software documentation procedures to facilitate future maintenance processes.

E. Deployment

The next stage is deployment, which is carried out after the system meets the requirements and then the software is ready for use.

F. User Acceptance Testing (UAT).

At the final stage of development, User Acceptance Testing (UAT) is conducted by customers or end-users to validate or accept the software system. The purpose is to validate the end-to-end business flow, review whether the created service meets the users' needs, and ensure that the software is user-friendly and easy to use. UAT is the last phase of the software testing process and is performed before the tested software is released to the target market.

III. RESULTS AND DISCUSSION

The following are the results and discussions of the implementation of the agile method in designing a web-based new student admission information system.

A. Planning

In the planning stage, system requirements analysis is conducted after data collection. The resulting system requirements to be developed consist of two roles, namely user and admin. The following are the system requirements from the user:

1) Register
2) View school information
3) View registration information
4) View school gallery
5) Register new students
6) Check admission status

The following are the system requirements for the admin role:

1) Login
2) View student data
3) Export data
4) Confirm admissions
5) User management

After conducting system requirements analysis, the next step is to create Unified Modeling Language (UML) designs, such as Use Case Diagrams, Activity Diagrams, and Sequence Diagrams.

1. Use Case Diagram

The following is the use case diagram, which represents the initial stage of system design and helps visualize the expected behaviour of the system from the user's perspective, as shown in Figure 3.

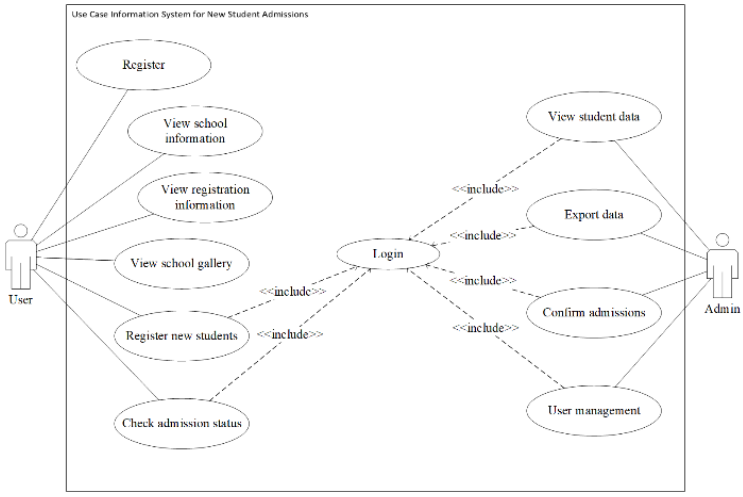

Fig. 3. Use Case Diagram

Figure 3 explains that there are two actors, namely the user and the admin. The user has access to register, log in, view school information, view registration information, view the school gallery, register new students, and check admission status. The admin has access to log in, view student data, export data, confirm admissions, and manage users.

2. Activity Diagram

Activity diagrams are used to model the workflow and activities that occur within a process. The following is the activity diagram for the user and admin actors that refers to the use case.

2.1 Activity Diagram for User

The following is the activity diagram for the user, which includes Register, View school information, View registration information, View school gallery, Register new students, and Check admission status. The activity diagram for user registration is shown in Figure 4.

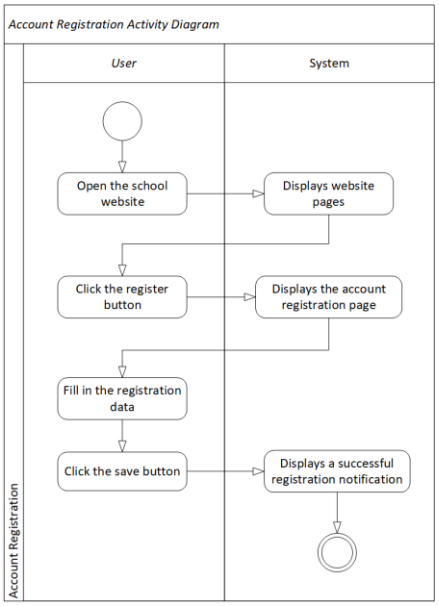

Fig. 4. Account Registration Activity Diagram

Figure 4 shows the activity diagram for account registration. After the user opens the website and the system displays the homepage, the user can register by clicking the registration button, filling in the required information, and clicking the register button.

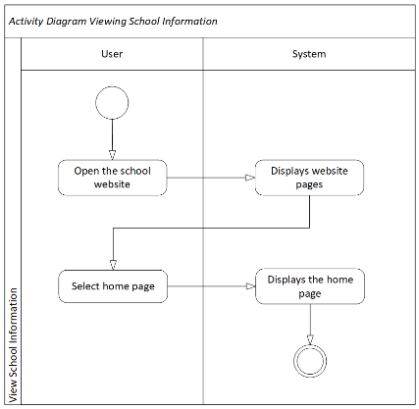

Fig. 5. Activity Diagrams View School Information

Figure 5 shows the activity diagram for viewing school information. After the user opens the school website, the user can select the homepage, and the system will display the homepage.

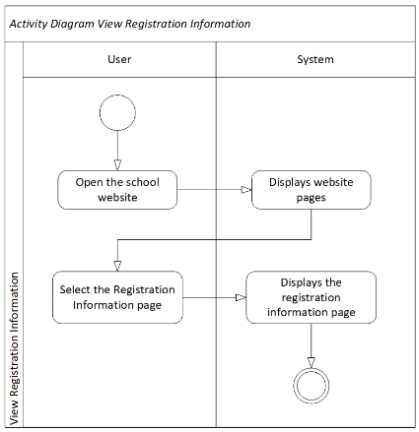

Fig. 6. Activity Diagram View Registration Information

Figure 6 shows the activity diagram for viewing registration information. After the user opens the website, they can select the registration information page, and the system will display the information page.

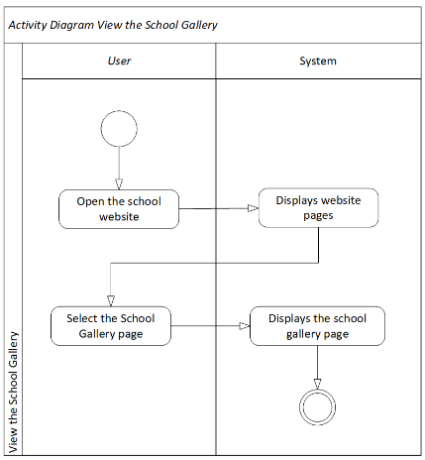

Fig. 7. Activity Diagram View the School Gallery

Figure 7 shows the activity diagram for viewing the school gallery. After the user opens the website, they can select the school gallery page, and the system will display the gallery page.

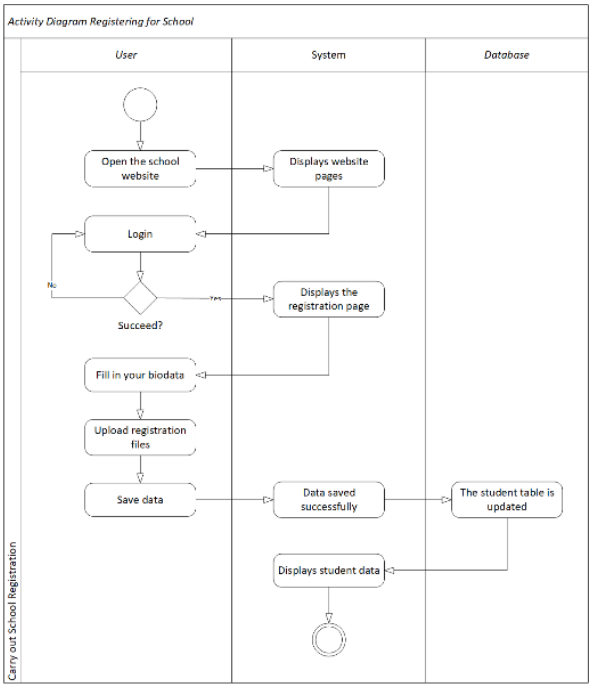

Fig. 8. Activity Diagram Registering for School

Figure 8 shows the activity diagram for registering new students. The user can select the register button and create an account. After successfully creating an account, the user can log in and fill out the registration form.

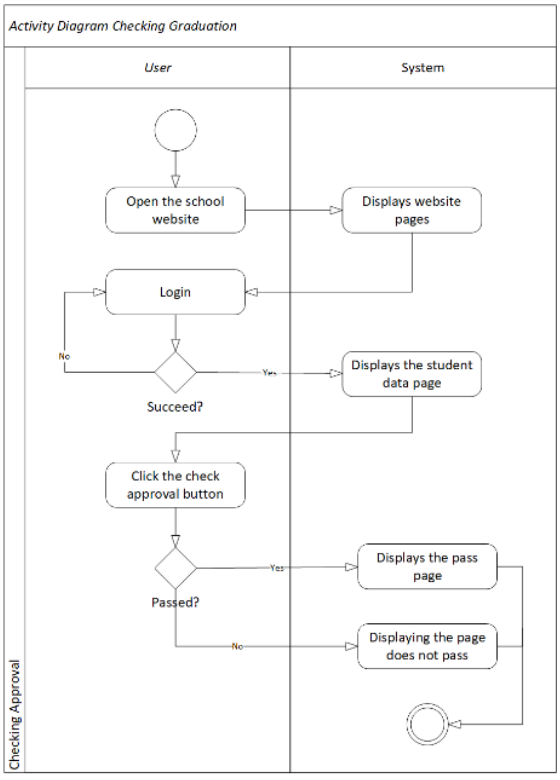

Fig. 9. Activity Diagram Checking Graduation

Figure 9 shows the activity diagram for checking admission status. The user can press the check admission status button on the student data page after logging in. If the student passes the selection, the system will display the admission success page. If not, the system will display the admission failure page.

2.2. Activity Diagram for Admin

The following is the activity diagram for the admin, which includes Login, View student data, Export data, Confirm admissions, and User management. The activity diagram for admin login is shown in Figure 10.

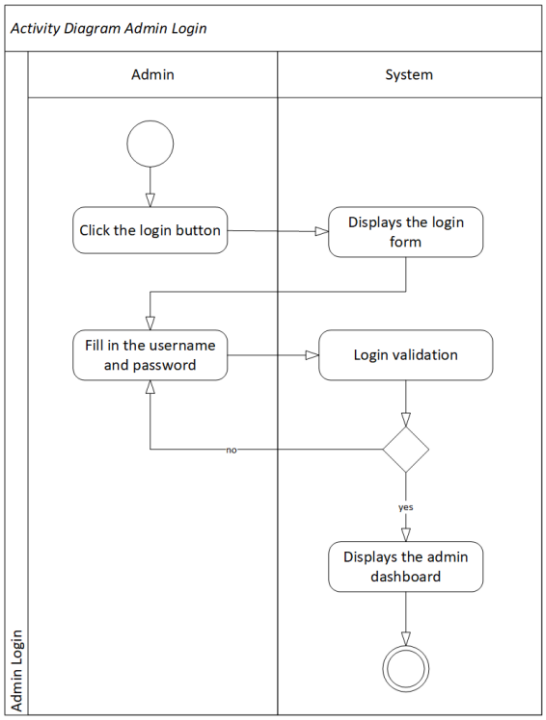

Fig. 10. Activity Diagram for Admin Login

Figure 10 shows the activity diagram for admin login. The admin can click the button. The system will display the login form, and the admin can enter the admin's username and password. After that, the system will validate the login. If the username and password entered are correct, the system will display the dashboard page. However, if the entered username and password are incorrect, the admin will need to re-enter the correct username and password.

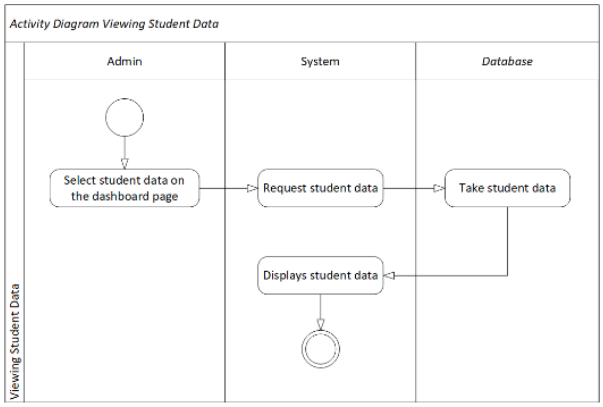

Fig. 11. Activity Diagram for View Student Data

Figure 11 shows the activity diagram for viewing student data. The admin can select student data on the dashboard page. The system will request student data from the database. The database will retrieve the student data, and the system will display the data.

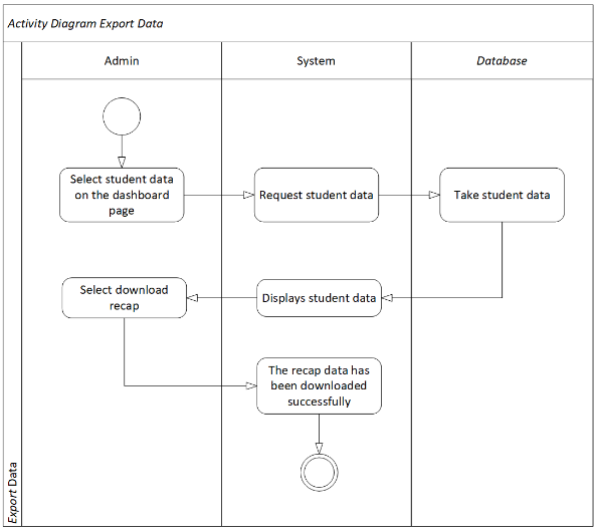

Fig. 12. Activity Diagram for Export Data

Figure 12 shows the activity diagram for data export. The admin can select student data on the dashboard page, and the system will request the student data from the database. The database will then retrieve the student data, and the system will display the data. After that, the admin can download the recap, and the recap will be downloaded.

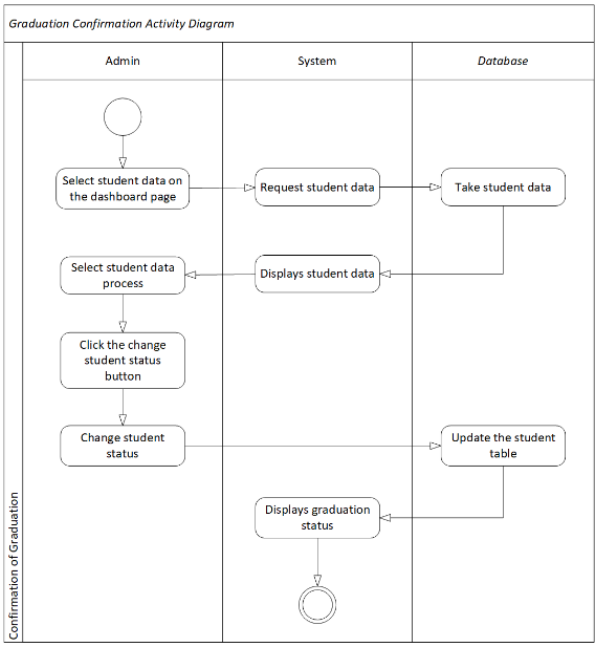

Fig. 13. Activity Diagram for Confirm Admissions

Figure 13 shows the activity diagram for confirm admission. The admin can select student data on the dashboard page. The system will display the student data requested from the database. Next, the admin can choose to process the student data and click the "change student status" button, and the student's status will be updated. The data in the database will be updated, and the system will display the student's graduation status.

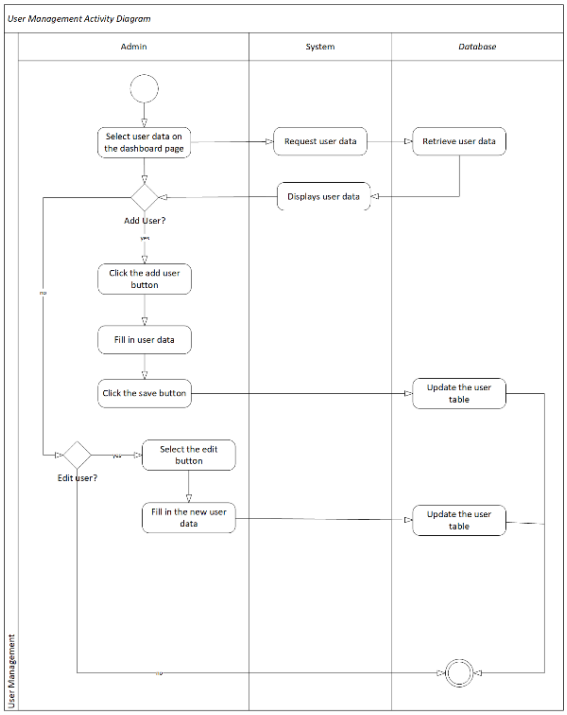

Fig. 14. Activity Diagram for User Management

Figure 14 shows the activity diagram for user management. The admin can select user data on the dashboard page. The system will request the user data from the database and display it to the admin. If the admin wants to add a user, they can click the "add user" button, then fill in the user data and click the "save" button. However, if the admin wants to update user data, they can click the "edit" button and modify the desired user data. The user table in the database will be updated, and the process will be complete.

3. Sequence Diagram

A sequence diagram provides a visual view of how objects interact with each other and what messages are sent between them during the execution of a use case or process. The following is the sequence diagram for the user and admin actors that refers to the use case.

Sequence Diagram for User

The following is the sequence diagram for the user, which includes Register, View school information, View registration information, View school gallery, Register new students, and Check admission status. The activity diagram for user registration is shown in Figure 15.

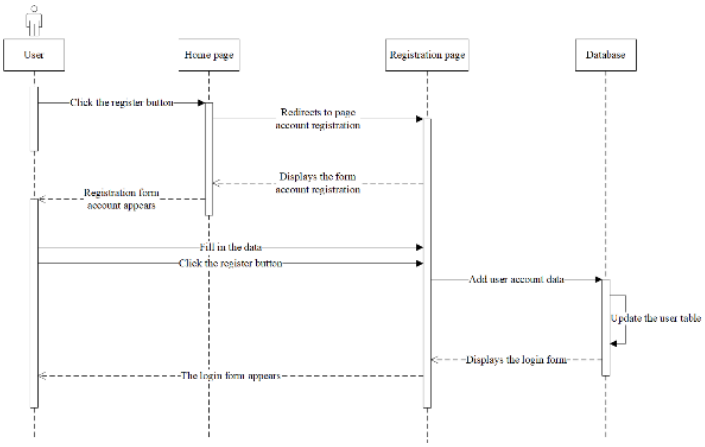

Fig. 15. Sequence Diagram for Account Registration

Figure 15 shows the sequence diagram for account registration. The user can click the register button, and the system will display the registration form. The user can fill in the data and register. The data will be saved, and the user table in the database will be updated.

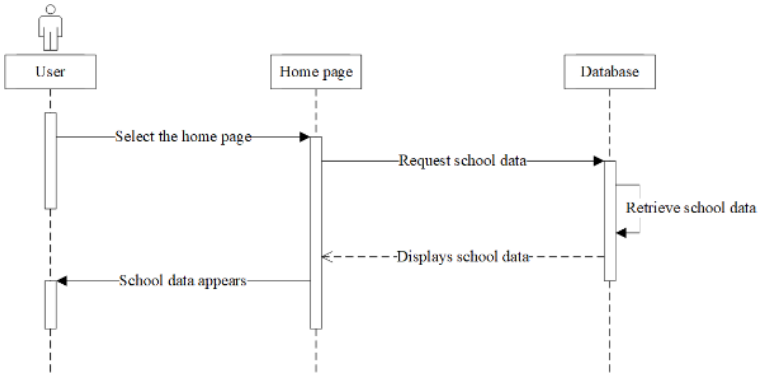

Fig. 16. Sequence Diagrams View School Information

Figure 16 shows the sequence diagram for viewing school information. The user can select the homepage. Then, the system will retrieve school data from the database and display it to the user.

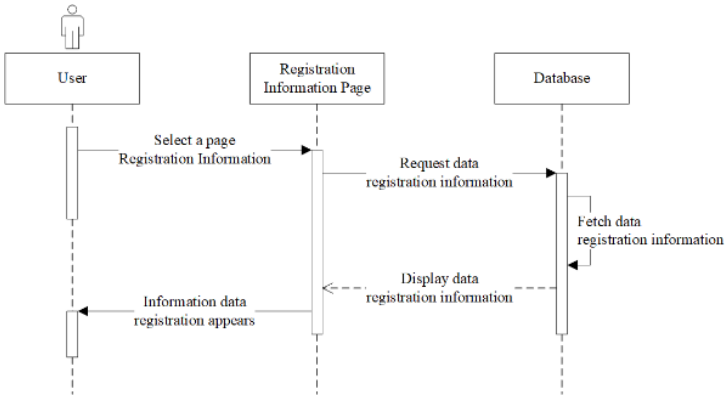

Fig. 17. Sequence Diagram Viewing Registration Information

Figure 17 shows the sequence diagram for viewing registration information. The user can select the registration information page. Then, the system will retrieve registration information data from the database and display it to the user.

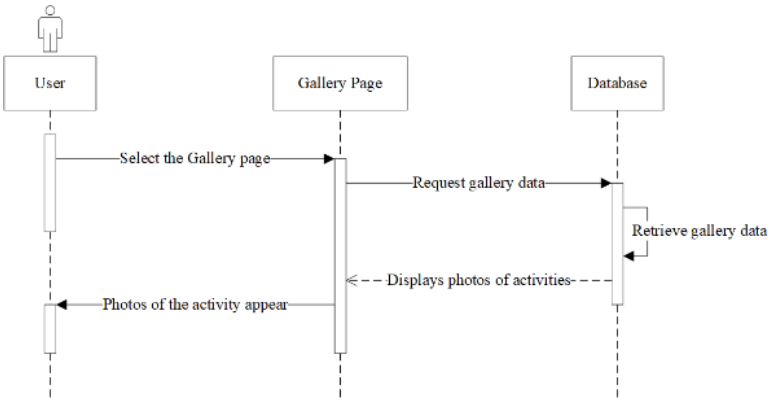

Fig. 18. Sequence Diagram View School Gallery

Figure 18 shows the sequence diagram for viewing the school gallery. The user can select the gallery page. Then, the system will retrieve school gallery data from the database and display it to the user.

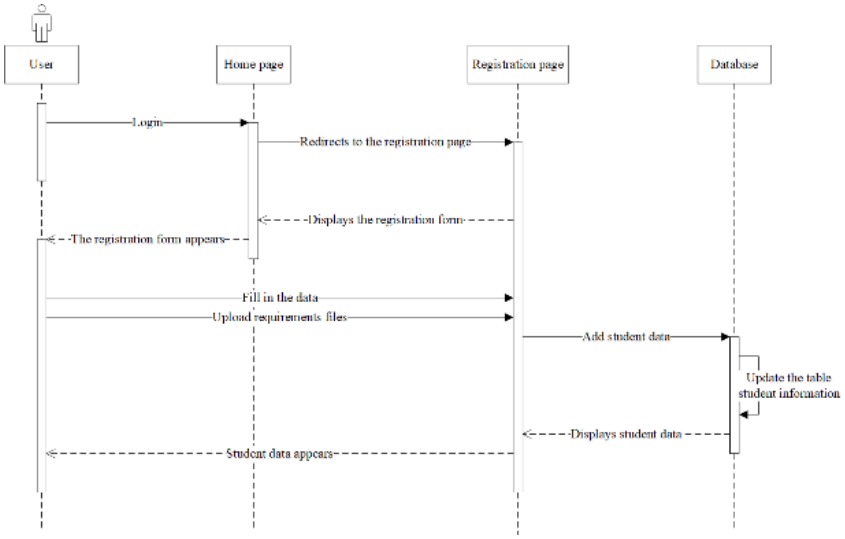

Fig. 19. Sequence Diagram for Registering New Students

Figure 19 shows the sequence diagram for registering new students. The user can log in. The system will display the registration form, and the user can fill in the data. Next, the data will be added to the database and the saved student data will be displayed to the user.

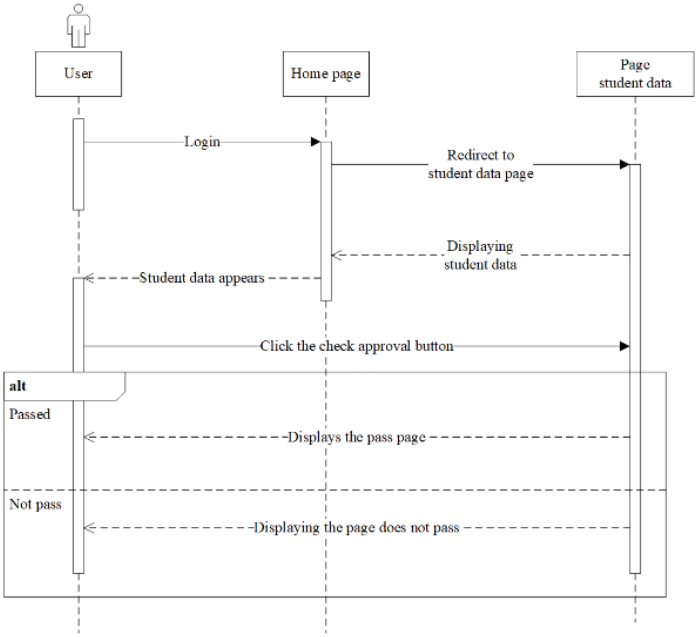

Fig. 20. Sequence Diagram Checks Graduation

Figure 20 shows the sequence diagram for checking admission status. The user can log in using a previously registered account. The system will display the entered student data, and the user can press the check admission status button on that page. The system will display the appropriate page based on the student's admission status.

Sequence Diagram for Admin

The following is the sequence diagram for the admin, which includes Login, View student data, Export data, Confirm admissions, and User management. The sequence diagram for admin login is shown in Figure 21.

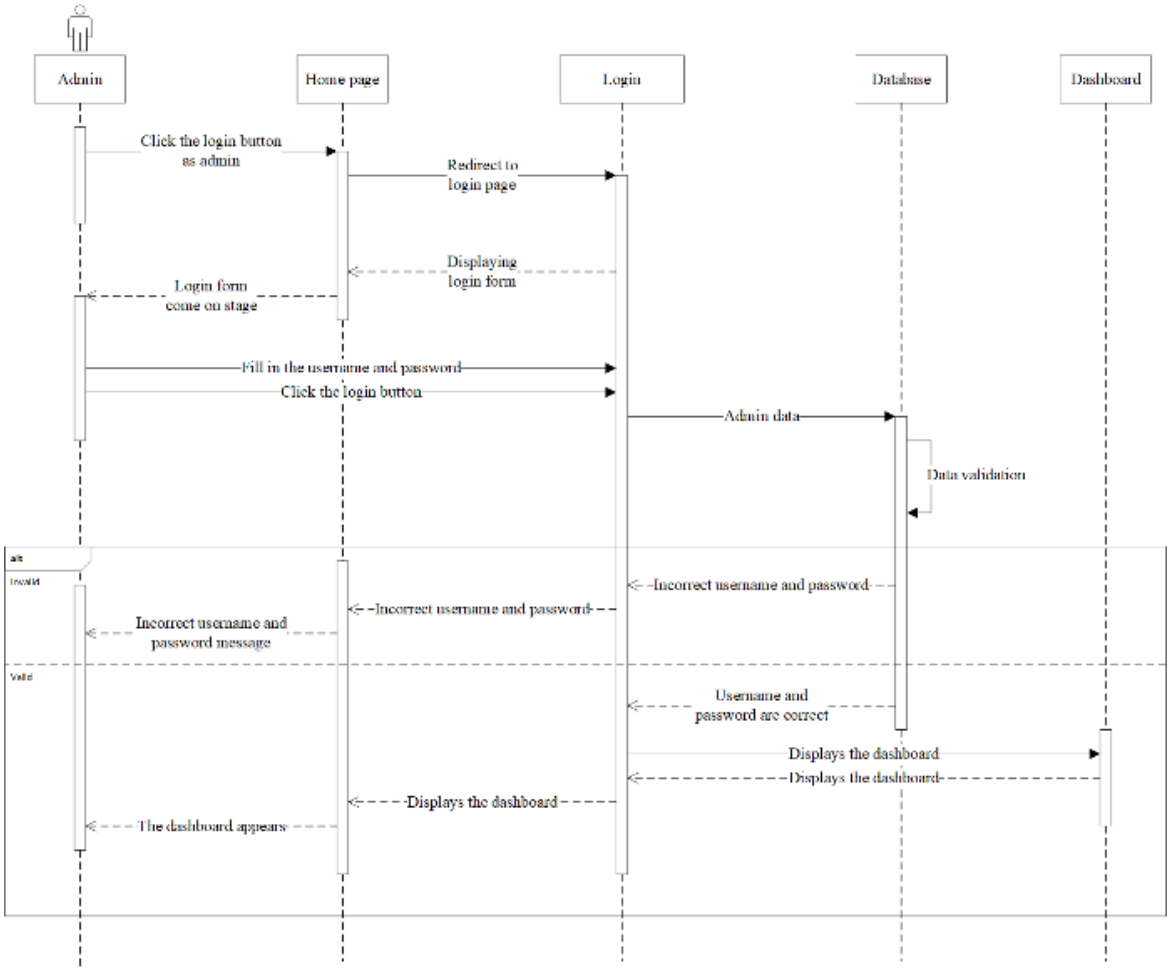

Fig. 21. Sequence Diagram for Login Admin

Figure 21 shows the sequence diagram for login admin. The admin can click the "login as admin" button on the homepage and will be redirected to the login page. Once the login page is displayed, the admin can enter their username and password. The database will validate the data. If the information is correct, the dashboard will be displayed. However, if the data entered is incorrect, a "incorrect username and password" message will be sent.

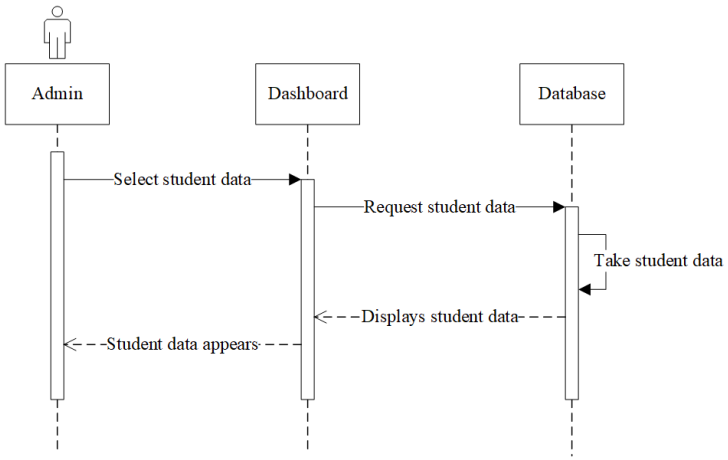

Fig. 22. Sequence Diagram for View Student Data

Figure 22 shows the sequence diagram for view student data. The admin can select student data on the dashboard, and the student data will be requested. The database will retrieve the student data, and it will be displayed on the dashboard.

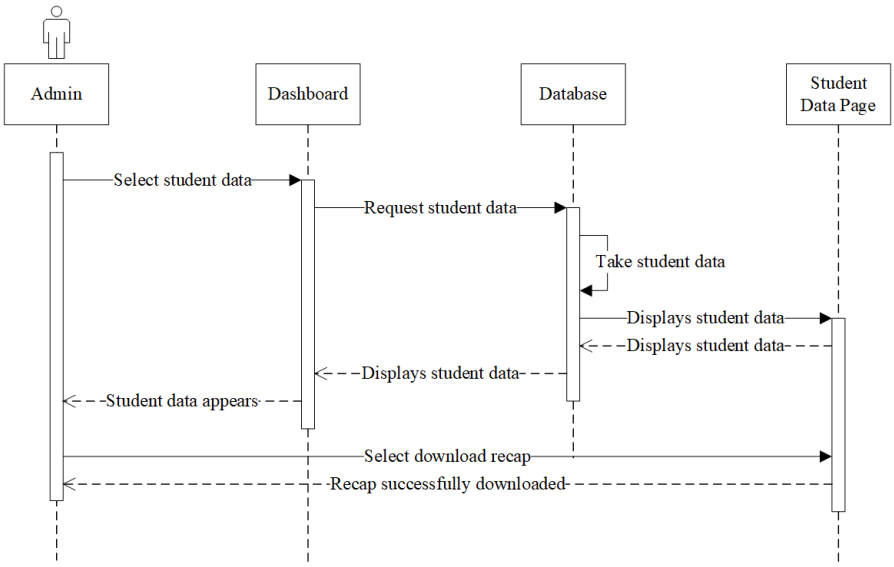

Fig. 23. Sequence Diagram for Export Data

Figure 23 shows the sequence diagram for export data. The admin can select student data on the dashboard. The student data will be retrieved from the database and displayed to the admin. Then, the admin can download the recap on the student data page, and the data recap will be successfully downloaded.

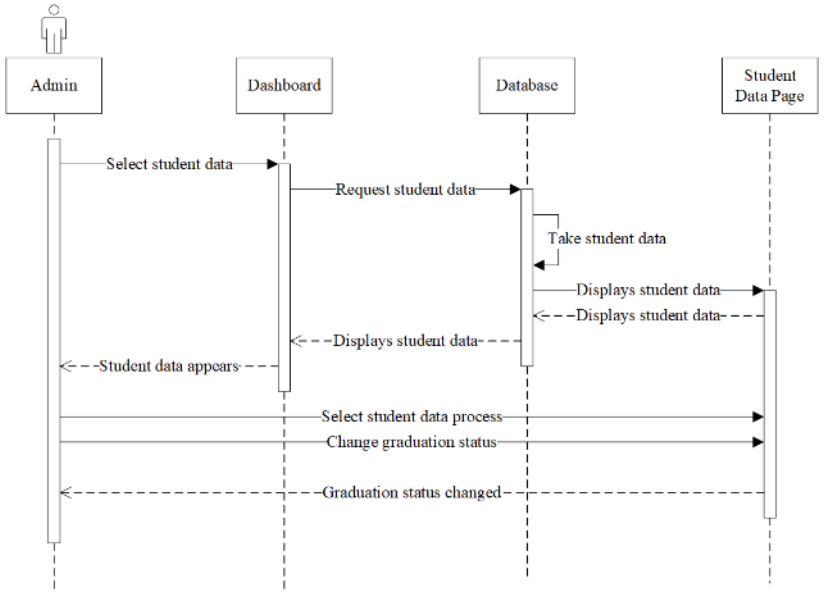

Fig. 24. Sequence Diagram for Confirm Admissions

Figure 24 shows the sequence diagram for confirm admissions. The admin can select student data on the dashboard. The student data will be retrieved from the database and displayed to the admin. Then, the admin can select the student data process and set the graduation status. The graduation status was successfully updated.

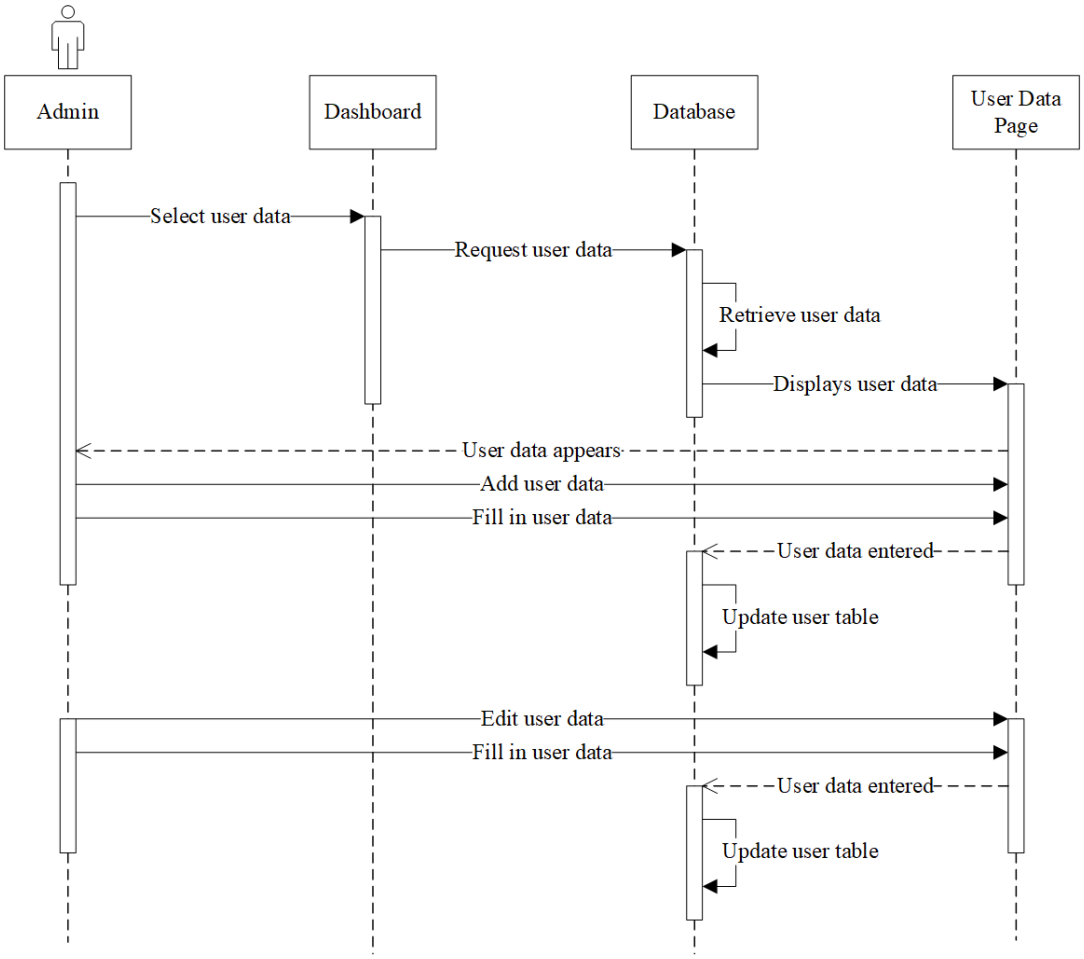

Fig. 25. Sequence Diagram for User Management

Figure 25 shows the sequence diagram for user management. The admin can select user data. The user data will be retrieved from the database and displayed to the admin. Next, the admin can add user data, and the user table in the database will be updated. The admin can also edit user data by entering new user information, and the user table in the database will be updated.

B. Implementation

In the implementation stage, software programming is carried out according to the existing UML design. The development of the new student admission information system based on a website is done using the Laravel framework.

C. Software Test

In the testing stage, the New Student Admission Information System will utilize a blackbox testing technique with 20 respondents, who are parents acting as users, to test the functionality of features available on the website. This testing is conducted with several different devices. The functionality testing can be seen in Table I.

TABLE I. FUNCTIONALITY TESTING

Number	Code	Testing Scenarios	Expected results
1.	A	Open the website	The website can run smoothly and display the homepage for the first time.
2.	B	Click the "Home" menu in the navbar.	The system will display the home page.
3.	C	Click the "Registration Information" menu in the navbar.	The system will display a registration information page.
4.	D	Click the "School Gallery" menu in the navbar.	The system will display the school gallery page.

Number	Code	Testing Scenarios	Expected results
5.	E	Click the "Register" button in the navbar.	The system will display an account registration form.
6.	F	Fill in your name, email, phone number, and password, then click register on the account registration form.	The system will receive the data entered by the user and display a login form.
7.	G	Fill out the login form using email and registered password.	The system will receive the data that has been entered by the user, followed by the system displaying the data entry page.
8.	H	Fill in your personal data and upload the required files on the new student registration form.	The system will receive the data that the user has entered, and after that, the system will display the data that the user has entered.
9.	I	Click the "check graduation" button at the bottom of the prospective new student data page.	The system will display a page with a passing statement for students who pass and a page with a failure statement for students who do not pass.

Table II shows the results of blackbox testing of the new student admission website by 20 respondents acting as users.

TABLE II. BLACKBOX TESTING RESULTS

Code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
B	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
D	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
E	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
F	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
G	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
H	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

In Table II, nine functionality testing scenarios on the user page have yielded a "Successful" test result after blackbox testing by 20 respondents who are parents of TK Al-Fath students.

D. Documentation

In this stage, documentation is carried out to create modules from blackbox testing after testing on the created website. These modules are used as records during development and to facilitate further development.

E. Deployment

In this stage, the newly created web-based student admission information system is published for use by the end-users, namely TK Al-Fath and the parents of prospective TK Al-Fath students.

F. User Acceptance Testing (UAT)

After conducting blackbox testing, users were given a questionnaire to complete a User Acceptance Test aimed at measuring general user perception and satisfaction and determining whether the new student admission website provides a solution for users. The User Acceptance Test (UAT) was conducted by the same 20 participants who participated in the black box test. Users were given 12 questions about the new student admission website, which were then measured using a Likert scale. The following is the list of questions presented in Table III.

TABLE III. UAT SURVEY QUESTIONS

Number	Code	Question
Satisfaction and Ease of Use of the TK Al-Fath New Student Admission Website.		
1	U1	Is the Al-Fath Kindergarten new student acceptance website easy to use?
2	U2	Is the website for accepting new students at Al-Fath Kindergarten easy to understand?
3	U3	To what extent do you feel comfortable with the registration process provided by the website?
4	U4	To what extent do the instructions provided on the website feel clear and easy to follow?
5	U5	To what extent do you find it easy to fill out the registration form on this website?
6	U6	To what extent does this application meet your business needs?

Number	Code	Question
Availability of Information		
7	U7	To what extent is the information required for school registration clearly available on the website?
8	U8	To what extent does the information presented on the website match your needs for school registration?
9	U9	To what extent are you satisfied with the availability of support contact options or technical assistance if you experience problems while using the website?
Design Quality		
10	U10	Is the design and appearance of the Al-Fath Kindergarten new student acceptance website attractive?
11	U11	To what extent are you satisfied with the user interface of this app?
Mobile Responsive		
12	U12	To what extent is this website responsive and can be accessed well via mobile or tablet devices?

Next, feasibility calculations will be performed and translated into qualitative values through interpretation using a Likert scale, as shown in Table IV.

TABLE IV. SCORE INTERPRETATION CRITERIA

Score Intervals	Percentage	Level Category
1	Value 0 to 20%	Very bad
2	Value 21 to 40%	Bad
3	Value 41 to 60%	Enough
4	Value 61 to 80%	Good
5	Value 81 to 100%	Very good

The data obtained will be calculated using the following formula.

$$\text{Total test score} = \sum n \times b \quad (1)$$

The value of n represents the score interval from the Likert scale (1-5), and the value of b is the number of users who gave that score. Next, the feasibility percentage is calculated using the following formula.

$$Feasibility\ percentage = \frac{Total\ test\ score}{Maximum\ total\ score} \times 100\% \quad (2)$$

The maximum total score is the highest score on the Likert scale, which is five. Then, the maximum score is multiplied by the total number of users, which is 20 people. Therefore, the maximum total score obtained is 100.

Test results from User Acceptance Testing (UAT) can be seen in Table V. Referring to the score interpretation criteria in the UAT, it was found that each tested indicator, namely satisfaction and ease of use, information availability, design quality, and mobile responsiveness, falls into the "Very Good" category with a total percentage of 93.58%. Therefore, it can be concluded that the TK Al-Fath new student admission website meets user needs and has been accepted by users.

TABLE V. UAT TEST RESULTS

Number	Code	Answer					Percentage (%)
		5	4	3	2	1	
1	U1	17	3	0	0	0	97
2	U2	15	3	2	0	0	93
3	U3	17	3	0	0	0	97
4	U4	11	9	0	0	0	91
5	U5	15	5	0	0	0	95
6	U6	13	7	0	0	0	93
7	U7	17	3	0	0	0	97
8	U8	17	3	0	0	0	97
9	U9	15	2	3	0	0	92
10	U10	13	3	4	0	0	89
11	U11	13	6	1	0	0	92
12	U12	10	10	0	0	0	90
Total Percentage							93.58

IV. CONCLUSION

Based on the research stages conducted by applying the Agile method and blackbox testing, it can be concluded that this research resulted in a Web-Based New Student Admission Information System with two roles: user and admin. This NSIS can be accessed with internet-connected devices. In the blackbox testing, there were nine functionality testing scenarios on the user page, all of which had "Successful" results after blackbox testing by 20 respondents who are parents of TK Al-Fath students. The satisfaction percentage of the NSIS at TK Al-Fath is 93.58%, falling into the "Very Good" category. Users are satisfied with the efficiency and effectiveness of the new student admission process at TK Al-Fath using the web-based information system.

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