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Developing a Class Scheduling Mobile Application for Private Campus in Tangerang with the Extreme Programming (XP) Model

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ABSTRAK

Proses penjadwalan kelas pada sebuah kampus swasta di Tangerang, masih memiliki beberapa kendala. Jadwal perkuliahan yang disebarluaskan kepada mahasiswa dan dosen melalui aplikasi pesan singkat seperti WhatsApp (*WhatsApp Group Chat*) dan layanan email menyebabkan terjadinya duplikasi file jadwal. Selain itu, saat dilakukan revisi jadwal kuliah rentan terjadinya penumpukan file jadwal kuliah (redundansi data). Masalah lain yang terjadi adalah pada saat aktivitas reminder jadwal kuliah harian kepada mahasiswa dan dosen masih dilakukan secara konvensional dengan mengirimkan foto lembaran jadwal kuliah harian melalui grup WhatsApp. Untuk mengatasi masalah tersebut, dikembangkan sebuah aplikasi penjadwalan kelas berbasis mobile menggunakan tools Flutter dengan model Extreme Programming. Beberapa tahapan telah dilakukan pada penelitian ini dan melibatkan users dalam pengumpulan data kebutuhan. Sebelum Aplikasi tersebut digunakan oleh users, dilakukan pengujian aplikasi menggunakan metode *User Acceptance Test* (UAT) dengan model *Black-box testing*. Dari hasil pengujian UAT diperoleh hasil sebesar 92,82% dengan indikator sangat baik dan sesuai dengan kebutuhan pengguna.

Kata Kunci:

Extreme Programming, Flutter, Mobile-Apps, Penjadwalan perkuliahan.

Keywords **:**

Class scheduling, Extreme Programming, Flutter, Mobile-Apps.

ABSTRACT

The class scheduling process at a private campus in Tangerang still has several obstacles. Class schedules disseminated to students and lecturers via short message applications such as WhatsApp (WhatsApp Group Chat) and e-mail services cause duplication of schedule files. In addition, when revisions to class schedules are prone to the accumulation of class schedule files (data redundancy). Another problem occurs when the daily class schedule reminder activity for students and lecturers is carried out conventionally by sending photos of daily class schedule sheets via the WhatsApp group. A mobile-based class scheduling application was developed using Flutter tools with the Extreme Programming model to overcome this problem. Several stages have been carried out in this study and involve users in collecting data needs. Before users use the application, application testing is carried out using the User Acceptance Test (UAT) method with the Black-box testing model. From the results of the UAT test, the results obtained were 92.82% with excellent indicators and following user needs.

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INTRODUCTION

The development of smartphones is increasing rapidly, and sophisticated smartphones are directly proportional to the increasing number of mobile-based applications. Previous research was conducted by reviewing the literature on agile methods, which have many models for developing mobile-based applications. The literature reviewed included 44 kinds of literature. The model most frequently used in mobile-based application development was the Extreme Programming (XP) model, with a percentage of 41%. Furthermore, the least used models are the Object-Oriented Agile Development (OOAD) and Rational Unified Process (RUP) models, with a percentage of 2% each. While the focus of the field that was used as the most research theme was the area of productivity, with a percentage of 23% and the least used as a research theme was in the fields of food & beverage, health & fitness, books & references, weather and finance with a respective percentage of 2% (Larasati et al., 2021).

In developing a website-based information system, the agile method is one of the methodologies at the system development stage that has been widely used. Based on the results of previous studies, the agile method models used to develop website-based information systems were grouped, and the most widely used model was the scrum model. There are several models in the agile method, as follows: 1) Scrums: The scrum model is a model that prioritizes development speed. In the process, the information system project plan is checked continuously and adjusted to the reality of the project (Dewi et al., 2021). 2) Agile: The Agile model is a system development approach that allows changes at any time (Khosyi'ah et al., 2021). The agile method process required rapid adaptation to any change, and less time was invested in documentation and analysis because the clients continually viewed and tested the product and provided feedback (Permana et al., 2021). 3) Extreme Programming (XP): Extreme programming is a method that lightens the burden or speeds up the software development process. The characteristics of this method are suitable for research with a small number of team members. This method is flexible so that it can adapt to the changes that the customer wants. With this, it becomes easier for users to develop the system (Wicaksono & Baswara, 2020). 4) Spirals: The spiral model is a model that emphasizes more risk analysis. This model has four phases: planning or planning, risk analysis or risk analysis, engineering or implementation, and evaluation or evaluation of the making of the information system (Pramudita et al., 2021).

The background of this research is the class scheduling process carried out at one of the private campuses in Tangerang, STMIK Dharma Putra. In the process that runs when class scheduling occurs, several obstacles, namely: Duplication and accumulation of schedule files (data redundancy), occur when class schedules are distributed or schedule revisions via WhatsApp groups and email, besides that the activity of reminding class schedules every day is still carried out conventionally, namely sharing class schedule files on the WhatsApp messenger group a few hours before class starts. Based on previous research on mobile application design, the results show that the use of mobile applications in the information dissemination process can speed up the process (Rodriguez & Boyer, 2020). The issue of making a mobile application in an easy, fast, and reliable way has arisen. Therefore, many UI frameworks to create mobile web applications have been introduced, one of them being Flutter (Biørn-Hansen et al., 2019). To overcome this problem, a mobile-based class scheduling application was developed using Flutter tools with the Extreme Programming model. This research will be carried out according to the stages or phases of the Extreme Programming model.

After designing the application, the application testing uses the User Acceptance Test (UAT) method with a black-box testing model. UAT testing is carried out to measure the functional aspects of the application based on user needs as described in the use cases and activity diagrams (Ananda & Wiratama, 2022).

RESEARCH METHODOLOGY

In this study, researchers used the most appropriate method to solve the problems studied using the Agile Methodology with Extreme Programming Model. Extreme Programming (XP) is a model used in software engineering and is widely used by application or information system developers. XP is a software development approach or model that tries to simplify various stages in the development process so that this method becomes more adaptive and flexible. XP is not only focused on coding but covers all areas of software development. XP takes an 'extreme' approach in iterative development or development techniques through repeated cycles (GUNADI, 2021):

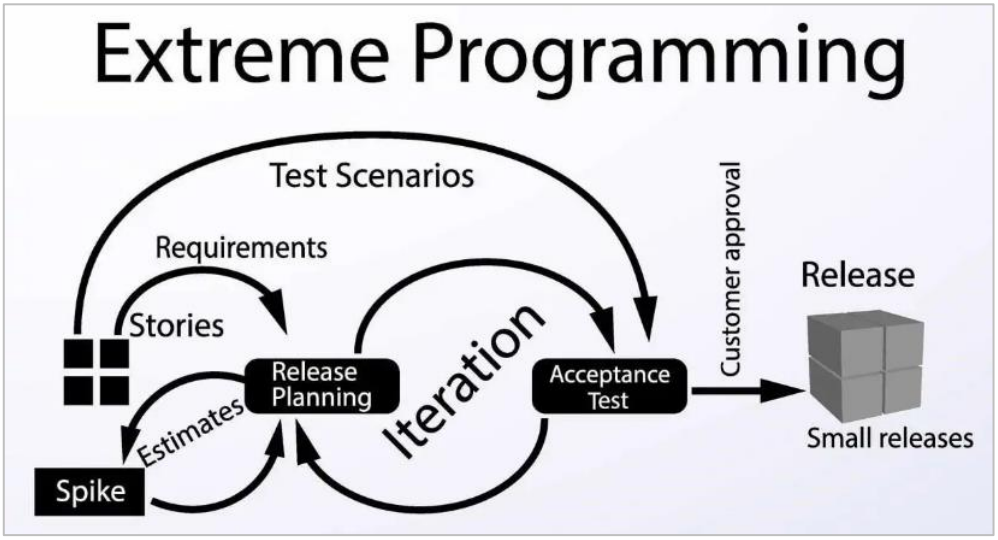

Figure 1. Extreme Programming Model

Figure 1 shows the stages or phases of the system development model using the Extreme Programming model. The first stage was User Stories to obtain system requirements from class scheduling application users. The user stories phase was conducted by interviewing 2 academic staff, 6 students, and 1 lecturer. System requirements are obtained from user stories, and a needs analysis is carried out. The following table 1 Requirements analysis:

Table 1. Requirements Analysis

No	Problem	Needs
1	Duplicate of data (data redundancy) on class schedules and schedule revisions.	Reduce the data redundancy for class schedules and schedule revisions.
2	The distribution of class schedules is often late.	Increase the speed of dissemination of class schedule information.
3	Reminding the class schedule is still conventional by taking a printed photo of the daily class schedule, distributed via the WhatsApp messenger group.	Make reminders of class schedules before the class starts.

After the requirements analysis is obtained, this research enters the spike stage, the stage for estimating or estimating the application model or possibilities that can occur in the design process. 2 types of estimates may occur, namely uncertain estimates and confident estimates. For uncertain estimates, the predictions are still biased with an unspecified scope, namely predictions of the completion time of the scheduling application design and the functions of the application based on user needs. Then for confidence estimates, the predictions must be narrow and specific so they can proceed to the Planning stage.

After getting the Requirements Analysis and Estimation from the Spike stage, the next stage is Planning. At the planning stage, Planning is carried out in designing a class scheduling application. The plan is carried out following table 2 of the work plan:

Table 2. Work Plan

No	Requirements	Planning
1	Interviews the users	Observe and Analysis the interview results
2	Application Use Case Diagram	Make a Use Case Diagram
3	Application Activity Diagram Aplikasi	Derive an Activity Diagram from the Use Case
4	Application User Interface	Make the Application Prototype using Figma
5	Application Development	Develop the Application using Flutter
6	Database Development	Develop the database using MySQL DBMS
7	Application Testing	Testing the Application using UAT

The next step is carried out by doing the Extreme Programming model's third stage, Iteration. At this stage, the application design will be carried out using use cases and activity diagrams, which are made based on the needs analysis of the functionality of the designed class scheduling application. After the application has been successfully designed, the User Acceptance Test (UAT) is then tested by System Users: Academic Staff, Students, and Lecturers. Tests follow the test scenarios during the class scheduling process and other scenarios that might occur when using the application. The final stage of this research is small releases, namely the implementation stage of the lecture scheduling application, which is distributed to Academic Staff, Students, and Lecturers. The distribution is done by sharing the application installer in APK format for the Android Platform from the Class Scheduling Application generated via an email link to the relevant users.

RESULTS AND DISCUSSION

In accordance with the stages in the Extreme Programming Model that has been carried out, starting from the initial stage to the iteration stage, this research will be continued based on user stories, spikes, and iteration results. This section describes the use case diagram, which describes the primary function of the class scheduling application. Then the use case diagram will derive into an activity diagram. However, in this study, not all existing use cases will be derived into activity diagrams, and what will be made into activity diagrams is the activity of adding schedules, changing schedules, and editing schedules. In the next section, several application/mock-up user interface designs made using Figma tools will be shown according to the use cases and activity diagrams so that the system design can be aligned with the designs made. The following is a use case diagram consisting of several actors (Academic Staff, Students, and Lecturers) when using the class scheduling application:

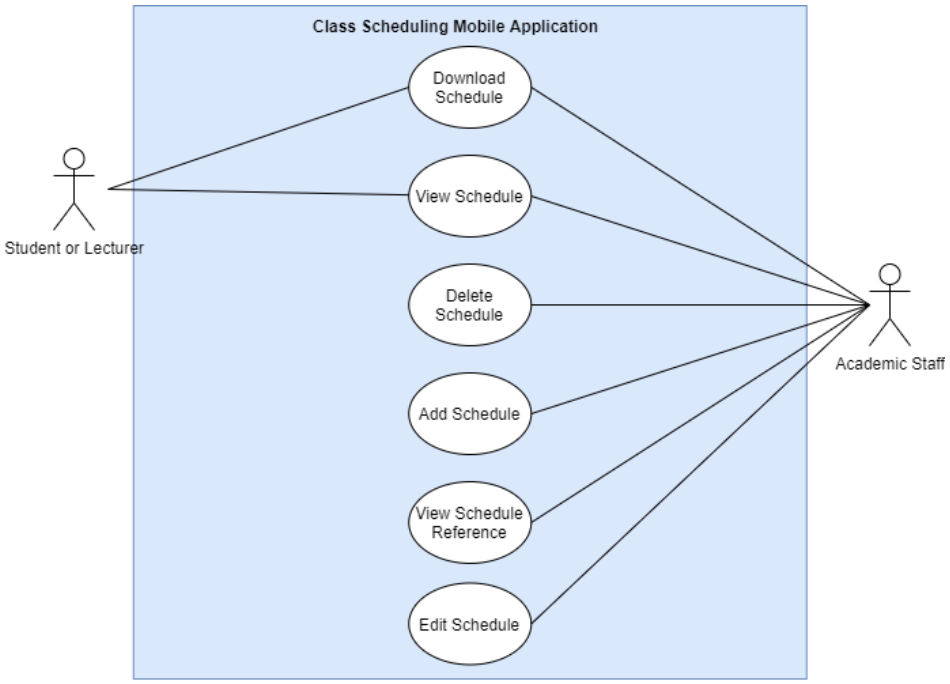

Figure 2. Use Case Diagram

In Figure 2, there are 2 actors shown, namely the Student or Lecturer and Academic Staff. Because Student and Lecturer users have the same function, the actors are made into 1 actor only. The use case diagram describes the 7 main functions used in class scheduling applications by each user. These functions include: download schedule, view schedule, delete schedule, add a schedule, view schedule reference, and edit schedule.

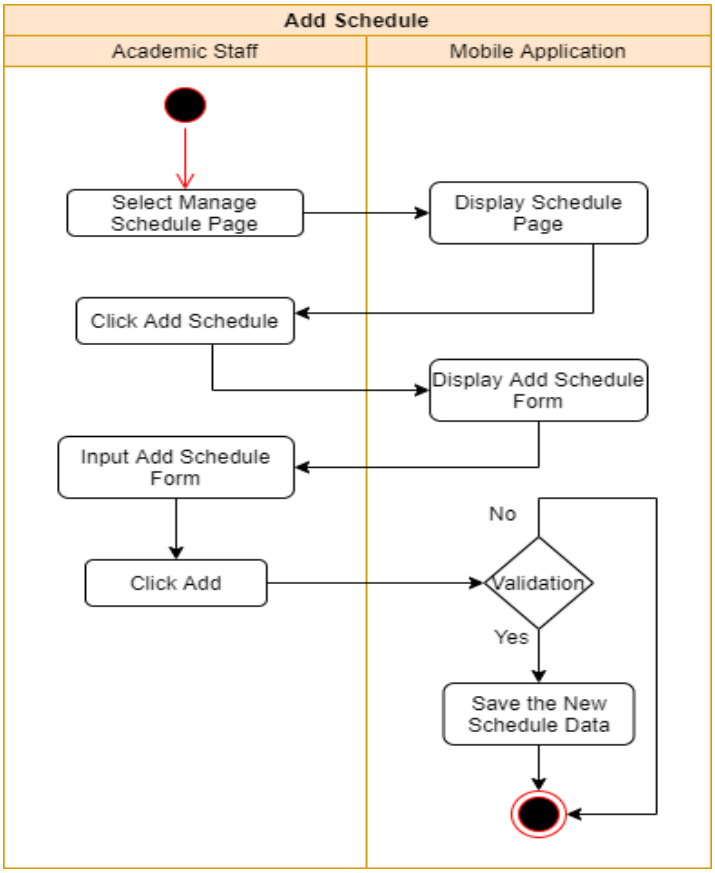

Figure 3. Activity Diagram of Add Class Schedule

After a use case diagram has been made, then to describe the application's primary functions, it will be derived into an activity diagram to describe the user scenario activity of application usage, which can be seen in Figure 3, Figure 4, and Figure 5.

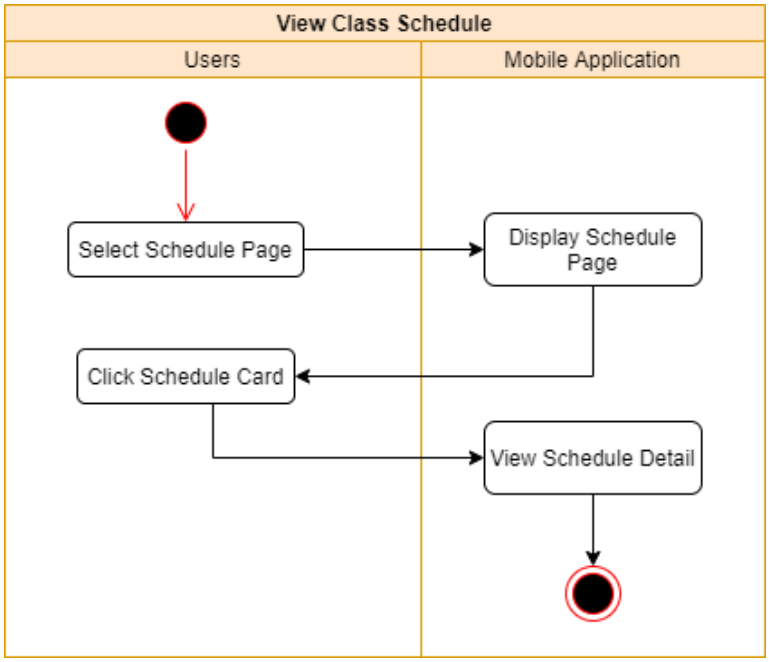

Figure 4. Activity Diagram of View Class Schedule

In Figure 4, a scenario is shown when users want to see the class schedule through the application, which starts by selecting the class schedule by clicking on the schedule card via the schedule page; then, the application will respond to the form of a detailed schedule page display.

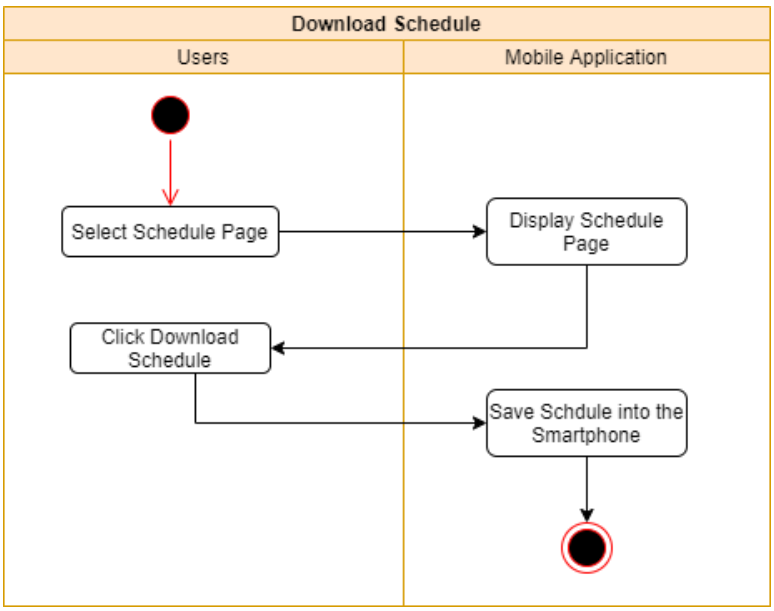

Figure 5. Activity Diagram of Download Schedule

In addition to adding class schedules and displaying class schedules, Figure 5 shows the activity when the user downloads the schedule by clicking on the download schedule button. After the user selects the option to download the schedule, the application will respond as a notification to save the schedule file in pdf format to the storage on the smartphone used. Schedule files saved can be accessed through the file manager and viewed with the Adobe Reader application or other applications that can read the pdf format.

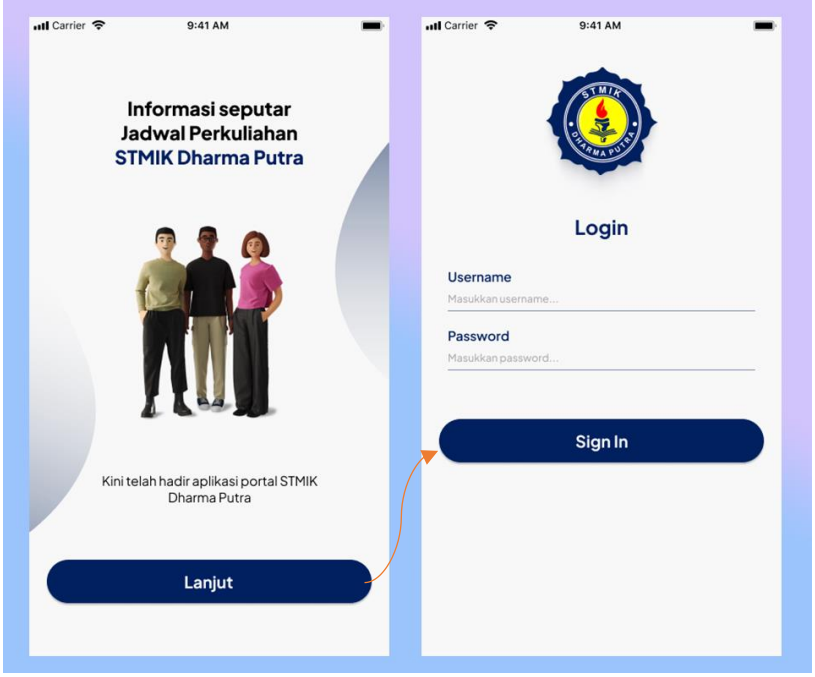

Figure 6. Home Screen and Login form User Interface

After the use case diagrams and activity diagrams are made, the next step is to design the user interface. The user interface in this research was made using tools Flutter according to the screen size of a standard smartphone in general (5-inch smartphone). Some buttons are connected to each other on the home screen and login form pages according to the arrows. Users can sign in in the input form section by inputting usernames and passwords. The username for students is NIM, and the username for lecturers is NIK.

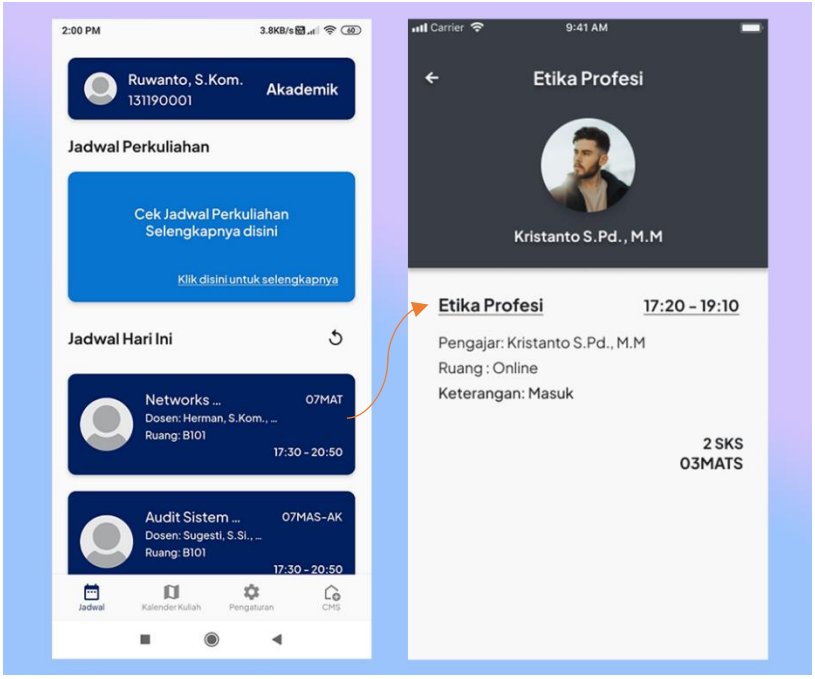

Figure 7. Schedule Page and Schedule Detail Page

On the class schedule menu, users can view and select class schedules that are held on that day. The schedule displayed on the menu contains information: Day, Subject, Class Code, and class time/hour from start to finish.

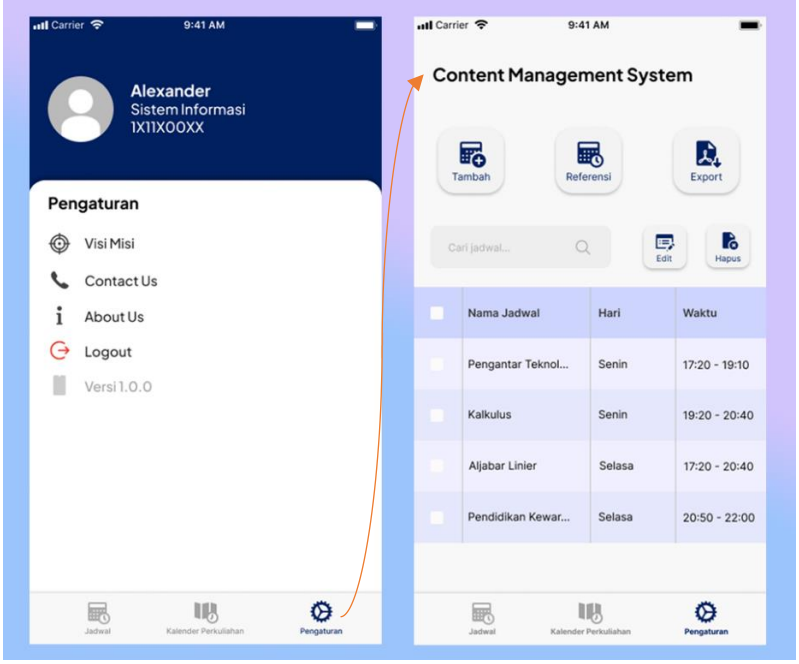

Figure 8. Settings and Content Management Systems Page

The last stage in this research is application testing, which uses the User Acceptance Test method. At this stage, functionality testing was carried out by 11 people who were users of the class scheduling application. The response of this test method has 5 different value criteria, ranging from very good or very agree, good or agree, neutral, not good or disagree, and very bad or strongly disagree. The following is a table of assessment criteria for the UAT testing method. The following are the results of the UAT, which can be seen in table 3:

Table 3. User Acceptance Test (UAT)

Total Percentages	Criteria	Score
20,00% - 36,00%	Very Disagree (STS)	1
36,01% - 52,00%	Disagree (TS)	2
52,01% - 68,00%	Neutral (N)	3
68,01% - 84,00%	Agree (S)	4
84,01% - 100%	Very Agree (SS)	5

Table 4. UAT results from 11 users

No	Questions	Score				
		SS	S	N	TS	STS
1	Is the appearance of this class scheduling application is attractive?	6	5	0	0	0
2	Is this application's use of colors, such as background colors, text, etc., appropriate?	7	4	0	0	0
3	Does the application's interface and menus easy to understand?	9	2	0	0	0
4	Does the buttons or cards in this application function properly?	8	3	0	0	0
5	Is this application's schedule list and schedule detail page easy to understand?	7	4	0	0	0
6	Does the application help users (students, lecturers, and academic staff) to get scheduling information practically?	7	4	0	0	0
7	Is the accessibility of this application easy to use?	8	3	0	0	0
8	Does the schedule displayed on this application provide sufficient information?	5	6	0	0	0

Table 5. UAT Calculations

No	Questions	Score					Total
		SS*5	S*4	N*3	TS*3	STS*1	
1	Q1	30	20	0	0	0	50
2	Q2	35	16	0	0	0	51
3	Q3	45	8	0	0	0	53
4	Q4	40	12	0	0	0	52
5	Q5	35	16	0	0	0	51
6	Q6	35	16	0	0	0	51
7	Q7	40	12	0	0	0	52
8	Q8	25	24	0	0	0	49

To obtain the average score for the UAT, the respondents' scores will be divided by the number of respondents (11 respondents). Meanwhile, the average value will be divided by 5, then multiplied by 100% to obtain a value presentation.

Table 6. UAT average and overall calculation

Question	Average Value	Percentage of Value
#1	50/11 = 4.54	(4.54/5) *100% = 90.8%
#2	51/11 = 4.63	(4.63/5) *100% = 92.6%
#3	53/11 = 4.81	(4.81/5) *100% = 96.2%
#4	52/11 = 4.72	(4.72/5) *100% = 94.4%
#5	51/11 = 4.63	(4.63/5) *100% = 92.6%
#6	51/11 = 4.63	(4.63/5) *100% = 92.6%
#7	52/11 = 4.72	(4.72/5) *100% = 94.4%
#8	49/11 = 4.45	(4.45/5) *100% = 89%

The overall calculation to get the result of the eight questions given to respondents is by dividing the sum of all percentage calculations by the number of questions given to respondents. The following is the overall calculation: (90.8% + 92.6% + 96.2% + 94.4% + 92.6% + 92.6% + 94.4% + 89%) / 8 = 742.6 / 8 = **92, 82%**. The average overall calculation obtained is 92.82% which indicates that the application tested through the User Acceptance Test (UAT) has excellent results.

CONCLUSION AND RECOMMENDATION

Conclusion

After all the stages in the Extreme Programming model were carried out in this study, the following conclusions were obtained: The Extreme Programming method is reliable and can be used to create mobile-based applications in a short time. The mobile-based class scheduling application can reduce data duplication (data redundancy) because when a schedule revision occurs, the schedule data in the database will be updated, and there is no need to re-send the schedule file like the previous business process. The User Acceptance Test (UAT) results on the class scheduling application received a score of 92.82%. This score indicates that the application is acceptable, easily understood by users, and fulfils needs related to practical scheduling information.

Recommendation

For further research and to obtain more optimal results, the development of application security features can be carried out using fingerprint or face recognition. Then in the design aspect, the interface design can be developed to make it more dynamic and flexible according to the size of the user's smartphone screen.

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