DEVELOPMENT OF ACADEMIC ADVISING INFORMATION SYSTEM APPLICATIONS AT MAKASSAR STATE UNIVERSITY USING THE ANDROID PLATFORM

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ABSTRACT
Advising is the process where students communicate about issues that may arise during their study period. However, it is often hindered by the busy schedules and different timetables between students and their academic advisors. Therefore, a system has been developed to facilitate the advising process using the Android platform. This research adopts the Research and Development (R&D) methodology, specifically using the waterfall development model. Data collection techniques include interviews and questionnaires. The application is tested based on the ISO/IEC 25010 quality standards, covering four aspects: functional suitability, performance efficiency, usability, and portability. The functional suitability testing involved two expert professors, and 24 features were tested, indicating that the application is "Suitable" for use. Portability testing on the application was conducted by observing the output on three Android versions: Nougat, Red Velvet Cake, and Tiramisu. The results showed that the application can run on all three Android versions. Performance efficiency testing utilized the Android Profiler tool to assess CPU, memory, and network usage while running the application. The findings revealed that CPU usage was less than 50%, memory allocation was 122.2 MB, and network usage was less than 48 KB/s. Usability testing conducted by students resulted in a test score of 81.6%, categorized as "Very Good" feasibility.

Keyword: Application, Academic Advising, Android

1. Introduction
Quality academic services are vital in educational institutions. The effectiveness of these services is measured by how well they meet students' needs [1]. One way to improve service quality is by enhancing academic services, especially regarding scheduling information such as courses offered each semester, instructors, classrooms, and class hours. Therefore, resources and facilities are needed to assist the advising process, including academic counseling, information on each student's progress, and monitoring by instructors to ensure that students continue to progress both academically and in extracurricular activities. Academic advising is a process where students meet with their academic advisor or mentor to discuss academic planning, class schedules, and related matters related to their study program. However, nowadays, direct meetings between students and academic advisors often do not occur due to the busy schedules of individuals and different timetables [2]. This can be attributed to factors such as additional job demands on the part of the instructors, time constraints on students due to involvement in various extracurricular activities, or even technical constraints like limited transportation facilities or health conditions. Thus, online guidance becomes increasingly important in ensuring the smooth progress of the academic process and the development of students' capabilities.

The college advising system is a crucial component in ensuring the smooth flow of academic processes in higher education institutions. A significant method to guarantee the effectiveness of the university's academic processes is through an advising system, aiming to assist students in achieving success in their studies and personal development [3]. A well-designed advising system facilitates the management of student and faculty data, aiming to improve the effectiveness and efficiency of the teaching and learning process. Universitas Negeri Makassar undoubtedly requires an effective advising system to manage student and faculty information.

The development of an advising information system at Universitas Negeri Makassar is intended to enhance the efficiency and effectiveness of the advising process. UPT TIK UNM has created and operates approximately 36 systems that support all academic activities and technology services in education [4]. One of the systems developed is the Advising Management Information System (SIM-PA) [5].

Given the challenges mentioned above, the researcher is developing an Android-based application based on SIM-PA at Universitas Negeri Makassar. By migrating the advising information system to the Android platform, it is anticipated that the
user experience can be improved, the advising process can become more efficient, and information accessibility will be enhanced.

2. Materials and Methods

a. Research Methodology

This research applies the Research and Development (R&D) approach using the waterfall model. The R&D method is a research approach utilized to create specific products and test their effectiveness. [6]. The waterfall model, also known as the classic life cycle or Linear Sequential Model, illustrates a systematic and sequential approach in software development. The steps in the waterfall model include the requirement analysis, design, implementation, testing, and maintenance.

b. Development Procedure

1) Requirement Analysis

The first step in the waterfall development model is user requirement analysis. In this research, the researcher will collect and search for data that will be used during the development of the advising information system.

2) Design

This stage involves designing the software architecture and determining how the software will be constructed. The researcher will utilize Unified Modeling Language (UML) software modeling, including necessary components such as Use Case Diagrams, Flowcharts, and Activity Diagrams.

![Use Case Diagram](image1)

**Figure 1. Use Case Diagram**

![Flowchart](image2)

**Figure 2. Flowchart**
3) Implementation
   This stage involves writing code to construct the software based on the previously created design. During the coding phase, the researcher will utilize the Flutter framework, which uses the Dart programming language. For the code editor, the researcher will use Visual Studio Code.

4) Testing
   In this stage, testing is conducted to ensure that the software functions properly as expected. Testing is performed using the ISO/IEC 25010 feasibility testing method to ensure the quality of the advising application's information system. The main focus of this research is to ensure the aspects of functional suitability, performance efficiency, portability, and usability in the information system used in the advising application.

5) Maintenance
   Maintenance is the final stage of the waterfall development model. This stage involves fixing errors and issues identified during testing or while using the software.

c. Data Collection Technique
   In this research, data will be collected through two techniques: interviews and questionnaires.

1) Interviews
   Interviews are a data collection technique with a specific purpose where two parties are involved: the interviewer who asks questions related to a specific topic, and the respondent who provides answers to those questions. Interviews are conducted to gather the necessary information for the development of the advising information system application.

2) Questionnaires
   Questionnaires are a data collection technique involving presenting a series of written questions to respondents for them to answer. In this study, a closed-ended questionnaire is used, providing predefined answer choices for respondents. The aim is to obtain information from system validators and users regarding the developed advising application. Questionnaires can be distributed in person, through messages, or via the internet.

Figure 3. Activity Diagram
d. Research Instrument
In this research, the tools used, referring to ISO/IEC 25010, are as follows:
1) Functional Suitability Instrument
To conduct Functional Suitability testing, a questionnaire prepared by two system experts will be used. The questionnaire validation will be performed by a lecturer from Universitas Negeri Makassar who is an expert in the field.
2) Performance Efficiency Instrument
This testing process will be conducted using a tool called Android Profiler. Android Profiler is a built-in tool in Android Studio that can be used to monitor the usage of CPU, memory, network, and other system resources in Android applications.
3) Portability Instrument
To test the portability characteristics in this study, experiments will be conducted in various environments, such as different types of Android devices.
4) Usability Instrument
To test Usability in the advising information system application, the USE Questionnaire introduced by A.M. Lund in 2001 will be used [7]. This questionnaire consists of 30 questions divided into 4 criteria: usefulness, ease of use, ease of learning, and satisfaction. The questionnaire will be given to respondents as one of the data collection instruments to evaluate how users perceive the application in terms of usefulness, ease of use, ease of learning, and satisfaction.

e. Data Analysis Technique
1) Analysis of Functional Suitability
To calculate the test results, the feature completeness matrix formula is used, which functions to measure the success level of existing functions to be implemented. Scores approaching 1 on the feature completeness matrix indicate how many functions have successfully been implemented in the tested software. If the value $X$ approaches 1, the software is categorized as good in terms of the feature completeness characteristic.

Table 1. Category of Alternative Answer Scoring

<table>
<thead>
<tr>
<th>Answer</th>
<th>Scores by Validator</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Validator 1</td>
<td>Validator 2</td>
</tr>
<tr>
<td>Yes</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>No</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Matrix formula Feature completeness can be seen in the following equation below

$$X = \frac{I}{P} \times 100\% \quad \ldots \quad (1)$$

Description:

$I$ = Number of features successfully implemented

$P$ = Number of features designed

The information that has been collected will be analyzed using qualitative descriptive analysis methods. The results of the analysis will be presented in percentage form to show the frequency distribution and percentage of the rating scale categories that have been identified, according to the way the data is presented. In addition, once the data eligibility level is confirmed, qualitative information can be enriched by using conversion tables in addition to the data.

Table 2. Conversion from Eligibility Percentage

<table>
<thead>
<tr>
<th>Percentage Eligibility</th>
<th>Criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\geq 50%$</td>
<td>Acceptable</td>
</tr>
<tr>
<td>$&lt; 50%$</td>
<td>Rejected</td>
</tr>
</tbody>
</table>

2) Performance Efficiency Analysis
In testing to measure the aspect of Performance Efficiency, a testing tool called Android Profiler, available in Android Studio, is used. In this testing, performance is measured relative to the resources used under certain conditions in the application system. The Android Profiler features a "Record" option to capture the application's performance over a specific period and analyze performance data over an extended period.
3) Portability Analysis
The goal of portability testing is to determine the system's ability to function in different environments. Testing is conducted on various types of Android devices. Portability is considered high when the system can operate on different versions of Android.
4) Usability Analysis
Usability testing on the application system is carried out using the USE Questionnaire by A.M. Lund [7], consisting of 30 questions divided into 4 criteria: usefulness, ease of use, ease of learning, and satisfaction. There are 20 respondents in this study, consisting of students in the Department of Educational Technology and Computer. Assessment is conducted using a

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Likert scale, a type of scale to measure attitudes, opinions, and perceptions of an individual or a group of people about social phenomena. The answer scores for each item in the questionnaire use a 5-point scale: strongly agree (SA), agree (A), neutral (N), disagree (D), and strongly disagree (SD).

To analyze Usability testing, a descriptive analysis technique is used to provide an overview and conclusion from the obtained data. To calculate the Usability testing scores, a conversion formula is used, which is then translated into score interpretation criteria in percentage form.

\[
\text{Usability Percentage} = \frac{\text{Scores obtained}}{\text{Max Score}} \times 100\% \tag{2}
\]

After obtaining the percentage scores from the test results, the next step is to compare them with the score interpretation criteria table that has been prepared. In this table, the success category of Usability testing will be determined based on the range of percentage scores obtained.

<table>
<thead>
<tr>
<th>Num.</th>
<th>Percentage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>81% - 100%</td>
<td>Excellent</td>
</tr>
<tr>
<td>2</td>
<td>61% - 80%</td>
<td>Good</td>
</tr>
<tr>
<td>3</td>
<td>41% - 60%</td>
<td>Neutral</td>
</tr>
<tr>
<td>4</td>
<td>21% - 40%</td>
<td>Bad</td>
</tr>
<tr>
<td>5</td>
<td>0% - 20%</td>
<td>Very Bad</td>
</tr>
</tbody>
</table>

3. Results

a. Requirement Gathering

At this stage, the researcher interviewed students at Makassar State University to gather information needed for the development of this advising application. The results of this stage are as follows:

1) The development of the web-based advising information system application at Makassar State University to Android-based is needed by students and lecturers to facilitate the advising process in lectures.

2) There are two users in the Android-based advising information system application at Makassar State University: lecturers and students.

3) Appointment schedule feature: this feature aims for students to be able to request meetings which will be confirmed by the lecturer if the request is approved.

b. Application Coding

At this stage, the researcher creates an advising information system application using the help of the Android Studio software using the Dart programming language with the Flutter framework with reference to the prototypes that have been made. The following are the results of the software that has been developed:

![Figure 2. Login Page](image)
This page contains a form to fill in the username and password to allow users who already have a registered account to enter the application.

![Image of a form]

**Figure 3. Students Main page**

On the student main page there is a slider menu consisting of 5 menus, namely Consultation (to display the student main page), advising lecturer (to display the advising lecturer's profile information), profile (to display the student's profile page), Schedule (to display the meeting schedule page with the lecturer), and log out (to remove the user from the application and go to the login page). The student main page is to create new consultations and see the history of their tutoring list as well.

![Image of a page with a list of students]

**Figure 4. Lecturer Main Page**

On this page there are icons consisting of 4 menus, namely the tutoring student menu (to display the lecturer's main page), the profile menu (to display the lecturer's profile page), the schedule (displaying the schedule page to confirm meeting requests made by students), and the log out button (to remove the user from the application and go to the login page). On the menu there is a list of the names of students guided by the lecturer and if clicked it will display the consultation list page of each student.
c. Application Testing
1) Functional Suitability Testing
Functional suitability testing was carried out by two system experts, Zulhajji, S.T., M.T. and Dr. Firdaus, S.Pd., M.T., responsible for this test. Each question is answered on a Guttman scale. The results of testing on the functional suitability aspect can be seen in the following table.

<table>
<thead>
<tr>
<th>Validator</th>
<th>Number of Designed Functions</th>
<th>Number of Successfully Implemented Functions</th>
<th>Feature completeness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24</td>
<td>24</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>24</td>
<td>24</td>
<td>1</td>
</tr>
</tbody>
</table>

Feature completeness = \( \frac{24}{24} \)

Based on these results, there are 24 features that have been successfully implemented with the results of feature completeness being 1 so it can be concluded that testing on the functional suitability aspect of the advising information system application at Makassar State University based on Android that has been developed is in the good category and suitable for use.

2) Portability Testing
The application was tested by running the application using android devices on various versions.

<table>
<thead>
<tr>
<th>Num.</th>
<th>Devices</th>
<th>Android Version</th>
<th>Successful</th>
<th>Failed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Vivo V7</td>
<td>Android Nougat Version 7.1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Realme 5 Pro</td>
<td>Android Red Velvet Cake Version 11</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Poco M4 Pro</td>
<td>Android Tiramisu Version 13</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Based on the test results, it can be concluded that the advising information system application at Makassar State University based on Android has met the portability aspect.

3) Usability Testing
The questionnaire given to users covers four aspects with a total of 30 questions. The results of the assessment from the user response test can be found in the following Table.

<table>
<thead>
<tr>
<th>Respondent</th>
<th>Usefulness</th>
<th>Ease of Use</th>
<th>Easy of Learning</th>
<th>Satisfaction</th>
<th>Total Score</th>
<th>Maximum Score</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>32</td>
<td>43</td>
<td>16</td>
<td>28</td>
<td>119</td>
<td>150</td>
<td>79.3</td>
</tr>
<tr>
<td>R2</td>
<td>32</td>
<td>44</td>
<td>16</td>
<td>31</td>
<td>123</td>
<td>150</td>
<td>82.0</td>
</tr>
<tr>
<td>R3</td>
<td>32</td>
<td>44</td>
<td>16</td>
<td>28</td>
<td>120</td>
<td>150</td>
<td>80.0</td>
</tr>
<tr>
<td>R4</td>
<td>32</td>
<td>44</td>
<td>16</td>
<td>28</td>
<td>120</td>
<td>150</td>
<td>80.0</td>
</tr>
<tr>
<td>R5</td>
<td>40</td>
<td>55</td>
<td>20</td>
<td>35</td>
<td>150</td>
<td>150</td>
<td>100.0</td>
</tr>
<tr>
<td>R6</td>
<td>33</td>
<td>45</td>
<td>17</td>
<td>28</td>
<td>123</td>
<td>150</td>
<td>82.0</td>
</tr>
<tr>
<td>R7</td>
<td>32</td>
<td>45</td>
<td>16</td>
<td>32</td>
<td>125</td>
<td>150</td>
<td>83.3</td>
</tr>
<tr>
<td>R8</td>
<td>32</td>
<td>44</td>
<td>16</td>
<td>31</td>
<td>123</td>
<td>150</td>
<td>82.0</td>
</tr>
<tr>
<td>R9</td>
<td>32</td>
<td>44</td>
<td>17</td>
<td>31</td>
<td>124</td>
<td>150</td>
<td>82.7</td>
</tr>
<tr>
<td>R10</td>
<td>39</td>
<td>53</td>
<td>20</td>
<td>33</td>
<td>145</td>
<td>150</td>
<td>96.7</td>
</tr>
<tr>
<td>R11</td>
<td>34</td>
<td>42</td>
<td>16</td>
<td>31</td>
<td>123</td>
<td>150</td>
<td>82.0</td>
</tr>
<tr>
<td>R12</td>
<td>32</td>
<td>46</td>
<td>16</td>
<td>28</td>
<td>122</td>
<td>150</td>
<td>81.3</td>
</tr>
<tr>
<td>R13</td>
<td>32</td>
<td>46</td>
<td>16</td>
<td>28</td>
<td>122</td>
<td>150</td>
<td>81.3</td>
</tr>
<tr>
<td>R14</td>
<td>34</td>
<td>45</td>
<td>16</td>
<td>29</td>
<td>124</td>
<td>150</td>
<td>82.7</td>
</tr>
<tr>
<td>R15</td>
<td>33</td>
<td>44</td>
<td>16</td>
<td>28</td>
<td>121</td>
<td>150</td>
<td>80.7</td>
</tr>
<tr>
<td>R16</td>
<td>34</td>
<td>45</td>
<td>17</td>
<td>32</td>
<td>128</td>
<td>150</td>
<td>85.3</td>
</tr>
<tr>
<td>R17</td>
<td>26</td>
<td>40</td>
<td>15</td>
<td>26</td>
<td>107</td>
<td>150</td>
<td>71.3</td>
</tr>
<tr>
<td>R18</td>
<td>28</td>
<td>40</td>
<td>15</td>
<td>26</td>
<td>109</td>
<td>150</td>
<td>72.7</td>
</tr>
</tbody>
</table>
Based on the calculation of the usability percentage above, 81.6% was obtained. These results indicate that the quality of the software for the advising information system application at Makassar State University based on Android from the usability aspect has been appropriate and if interpreted with the Likert scale it is included in the "very good" category.

### Performance Efficiency Aspect Testing

The analysis of the advising information system application at Makassar State University based on Android carried out in this test involves three aspects, namely CPU, memory, and network.

<table>
<thead>
<tr>
<th>Respondent</th>
<th>Aspect</th>
<th>Total Score</th>
<th>Maximum Score</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Usefulness</td>
<td>Ease of Use</td>
<td>Easy of Learning</td>
<td>Satisfaction</td>
</tr>
<tr>
<td>R19</td>
<td>29</td>
<td>40</td>
<td>15</td>
<td>28</td>
</tr>
<tr>
<td>R20</td>
<td>34</td>
<td>37</td>
<td>14</td>
<td>23</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Rating Category: **Very Good**

Usability percentage = \( \frac{2448}{3000} \times 100\% \)

Usability percentage = 81.6%
Based on the image above, the results obtained are real-time data for the CPU used is less than 50%, the memory used is 122.2 Mb, and the network used is less than 48 KB/s when the application is used, so it can be concluded that this application is feasible to use.

4. Discussion

Advising in colleges is a process where students meet with supervising lecturers or academic advisors to carry out the process of registering for courses and completing other academic administration. The existence of an academic advisor is very important to accompany students in achieving optimal learning outcomes, guiding career preparation, and helping students adjust positively [8]. The development of an Android-based advising information system at Makassar State University is designed to facilitate students and lecturers at Makassar State University in carrying out the tutoring process during lectures. This application was developed based on the SIM-PA (Advising Management Information System) web application [5]. This application was designed using the Dart programming language with the Flutter framework, with the application database storage using MYSQL. The use of the Flutter framework will make it easier for further developers if they want to develop this application because Flutter allows developers to create applications that run on different platforms such as Android and iOS using the same code base.

The development of an advising information system application at Makassar State University based on Android uses the Research and Development (R&D) research type using the waterfall development model [6]. The waterfall development model consists of 5 stages, namely requirements, design, implementation, verification, and maintenance.

The process of developing an advising information system application at Makassar State University based on Android begins with the requirement stage or application requirements analysis. The interview process was conducted with several students at Makassar State University. The results obtained at this stage are the application requirements needed in developing this advising application.

The next stage in development is application design or design, which aims to produce a model to be built. The design of this fertilizer ordering application based on Android includes flowchart diagrams, use case diagrams, activity diagrams, and interface designs. Each design element must be consistent, because this will have an impact on other design elements.

The next stage is implementation, where researchers began to build an Android-based advising information system application using Android Studio software with the Flutter framework, the programming language used by Flutter is the Dart programming language and the MYSQL database management system according to concepts or designs that have been made previously. Researchers also pay attention to every software detail made to ensure that the resulting software meets predetermined specifications and objectives. After software implementation is carried out, an advising information system application at Makassar State University is produced.

The next stage is verification, where the developed Android-based advising information system application will be tested based on software quality standards in ISO/IEC 25010. This is done to ensure the quality of the applications developed. In this study, 4 aspects of the ISO/IEC 25010 feasibility testing method were used, namely functional suitability, performance efficiency, usability, and portability [7]. Testing of the functional suitability aspect was carried out by 2 system experts and it was found that this application was in the good category for use. Performance efficiency aspect testing was carried out using the Android Studio profiler tool by measuring real-time data for the CPU used which is less than 50%, the memory used is 122.2 Mb, and the network used is less than 48 KB/s when the application is used, so it can conclude that this application is suitable for use. Usability aspect testing was carried out by Makassar State University students using a questionnaire distributed to 20 respondents with a feasibility percentage of 81.6% and is in the "very good" category. Portability aspect testing is carried out by running applications using android devices in various versions and the results obtained indicate that this android-based tutoring information system application runs well on various android versions.

The last stage is maintenance, where researchers continue to maintain software quality and reliability as well as be responsive to user needs, so that the android-based tutoring information system application can continue to be used effectively and efficiently. With the resulting application, it is expected that improvements in service in the tutoring process can significantly exceed the effectiveness of the previous platform.

In discussing the results of this study, comparisons were made with previous research conducted by Prayoga Erlangga Putra in the context of developing an android-based tutoring information system [9]. The results of this study are in line with the main findings of previous studies, which is producing a faster and more accurate tutoring information system. This research

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provides additional contributions by highlighting features to arrange meeting schedules between students and supervising lecturers through the application. The implications of these two studies can enrich the understanding of tutoring information systems in the context of Android application development.

5. Conclusion

Based on the results of research on the advising information system application at Makassar State University based on android that has been carried out, it can be concluded as follows:

1. The development of the advising information system application at Universitas Negeri Makassar, based on Android, resulted in an application designed using Android Studio software with the Flutter framework, Dart programming language, and MYSQL database management system. The development followed the waterfall model, consisting of 5 stages: requirement, design, implementation, verification, and maintenance. This application is intended to facilitate the advising process for both students and professors at Universitas Negeri Makassar.

2. The results of testing on the advising information system application at Makassar State University based on Android have met the ISO/IEC 25010 quality testing using 4 testing aspects, namely functional suitability, performance efficiency, usability, and portability.

References