The development of employee attendance application based on mobile using spiral method

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Abstract: The Pangulu Nagori Amborokan Panei Raya Office is one of the governmental institutions tasked with serving the local population. The Pangulu Nagori Amborokan Panei Raya office still records employee attendance using the manual approach. Employee attendance is noted in the attendance book. When done this way, there are still issues that come up. Particularly the time and effort put forth to complete the attendance procedure. In addition, because attendance data has very little protection and is accessible to anyone, it is challenging to summarize staff attendance reports. Building an Android-based application that can be used to process and track employee attendance is the aim of the author's research. The author employs UML to visually create the application design (Unified Modeling Language). The system development methodology, however, is a spiral that includes the phases of customer evaluation, planning, risk analysis, engineering, building, and disposal. The Kodular framework and the Airtable database are used in the development of an Android-based attendance application. The results of the study are an android-based attendance application that can be applied to make it easier for employees to take attendance and monitor employee attendance in real-time using an Android smartphone.

Keywords: android application, attendance record, spiral method

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Introduction

Nowadays, technological advancements have been made quickly. especially advancements in the science of information technology. This is seen in daily life, as it is common for Indonesians to use technology to carry out routine tasks. However, it is still uncommon for employees to use technology at work to assist with tasks or meet demands. While still employing conventional methods for working and gathering the necessary data, there is still a lot of work that should have been done using technology [1]. Android smartphone is a technological development in which use is increasing.

Google created the Android operating system, which is based on the Linux kernel and supports touch-screen gadgets like tablets and smartphones. Almost all adults possess and use an Android phone for communication, entertainment, shopping, transportation, and location-based services using the coordinates of their starting and ending points. Android is open source, which means that software creators and developers are free to use, change, maintain, and distribute it. They are free to use this OS on their devices without a license or for free due to the open-source nature of technology businesses [2].

Employee attendance, which is linked to discipline and affects each employee's performance, is crucial for a company or agency to achieve its goals. As a result, particular data collection is required to track attendance and attendance so that work activities can be properly and in real-time recorded [3].

One of the government entities tasked with serving the populace is the Pangulu Nagori Amborokan Panei Raya Office. The Pangulu Nagori Amborokan Panei Raya Office continues to use the manual approach for tracking employee attendance. An attendance book is used to track employee attendance. There are still issues that arise while doing it in this manner. Particularly the time and effort put into conducting the attendance process. Additionally, it is challenging to

summarize staff attendance reports, because attendance data has very low security and is accessible to anyone.

The author wishes to conduct research by designing and developing an employee attendance application at the Pangulu Nagori Amborokan Panei Raya Office based on Android in response to the issues raised above. Using an Android smartphone, this software can let staff take attendance and provide the Pangulu Nagori Amborokan Panei Raya Office with easy access to information about employee attendance.

Data collecting on attendance, hours out, and employee attendance recapitulation takes a comparatively long time in the process of calculating and finding data since the attendance procedure is done manually. The manual attendance procedure is prone to data loss, which could undermine the validity of the information used to generate staff attendance reports. As a result, the authors built a web-based employee attendance information system and performed research. The waterfall method was employed by the author to design the system. The Nagreg Village Office has implemented an employee attendance information system to manage staff attendance data and enhance agency performance [4].

Similar studies have explored manual student attendance systems, which are particularly inefficient because the student or the teacher noting the student's attendance incorrectly could have provided false information about their attendance. Therefore, it is imperative to use technology that can assist in processing student attendance at school. so that it can raise the standard of the system's attendance-related services for students. To conduct their research, the authors created web-based applications in JavaScript using the React framework and Google Sheets as their data sources. The waterfall method is the one utilized for system development. With the help of this system, teachers will be able to regulate student attendance more easily, which will improve attendance and allow for precise calculation of absenteeism recapitulation [5].

Similar studies have highlighted the lack of real-time information access provided by Madrasah Aliyah (MA) Yusuf Abdussatar Kediri, particularly when it comes to processing student attendance data. As a result, an information system was created that makes it easy to process student data using the MySQL database and PHP programming language, both of which are based on local area networks (LAN). The waterfall method is used for system development. By using an information system, it is possible to minimize losses and errors in recording student attendance data as well as to make the attendance procedure, data search, and attendance summary computation more convenient [6].

The authors' research differs from previous research in that it builds Android-based applications using the Kodular framework and the Airtable database. The writers create applications using the spiral technique, which incorporates the phases of customer communication, planning, risk analysis, engineering, construction, and disposal, as well as customer evaluation.

Methodology

The spiral approach of system development was employed by the author in this study. The spiral model, also known as the spiral method, is a type of evolution that combines the waterfall model's systematic elements with the natural iteration technique from the prototyping model. A prototype of the program is created during the prototyping stage, and examples are presented to users or customers to solicit feedback. The procedure continues with creating the actual product by adding to and fixing the flaws of the earlier prototype if it complies with the user's or customer's wishes.

This model also mixes top-down and bottom-up design, where top-down design first establishes the overall system before moving on to the system's specifics, and bottom-up design does the opposite. With feedback from the two combinations, namely a combination of design and prototyping as well as a combination of top-down and bottom-up, which also applied to the waterfall and prototype models, this spiral model can be said to be a process model as a result of the combination of the two models. The top-down design is typically applied to the sequential waterfall model, while the bottom-up design is typically applied to the prototyping model. Therefore, complicated and large-scale software development typically uses this model [7]. The spiral model display can be seen in Figure 1.
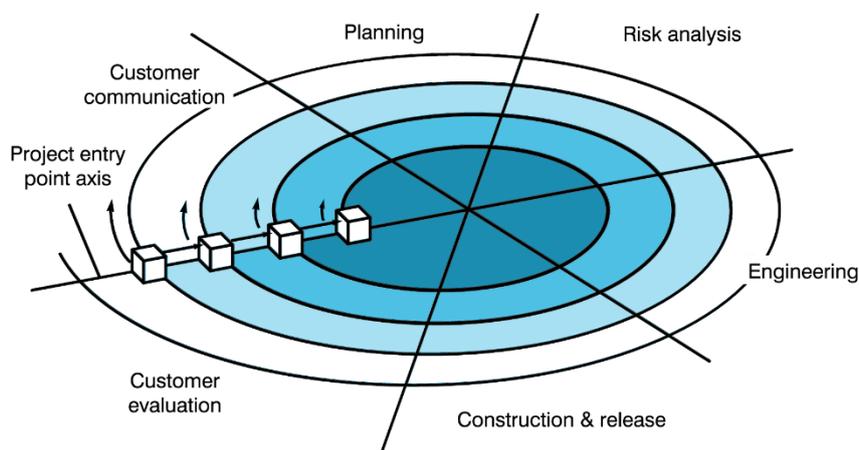
Figure 1. Spiral model

The activities used in the spiral model are listed below [8]:
Customer Communication
Activities particularly those pertaining to the needs of developers, were required to promote good communication between users or consumers and developers. Problem analysis and system requirements analysis are some of these processes.
Planning
Through this planning process, it is necessary to determine the data needed for software development, including resources and estimated processing times.
Analysis Risk
This risk analysis process evaluates managerial and technical risks. If iterations are not included in the process model, this phase might not occur; in such cases, the spiral model might be the only one where it does.
Engineering
Utilizing the Kodular framework and the Airtable database, create one or more technological representations of the actions related to an application.
Construction & Release
Software development, testing, installation, and user or customer support all involve training, documentation, and other procedures.
Customer Evaluation
Activities are necessary to get feedback from users or clients in response to assessments of how they portray the program at the engineering stage as well as during implementation during software installation during the build and release stage.

The primary method in research is data collection, which starts with gathering the data that serves as the study's principal goal. Of course, researchers cannot collect data that can supplement the existing data standards without knowledge of data collection methods [9].

The author followed the steps below to gather the information required to support this research:
Observation
In order to monitor the continuing staff attendance process and seek for issues that arise in the process at the Pangulu Nagori Amborokan Panei Raya Office, the author conducts direct observations at the research location.
Interview
The employee attendance method and the issues resulting from this approach are discussed by the author with employees and administrators at the Pangulu Nagori Amborokan Panei Raya Office.
Literature review
The author looks for references to the theories from books, journals, the internet, and other sources to assist research activities.

Results and Discussions

In this study, the author used the spiral methodology, which includes stages for customer evaluation as well as planning, risk analysis, engineering, construction, and release.

Customer Communication

The author now conducts customer interviews to gather all pertinent information about corporate operational operations. The author examines the systems needed and potential issues.

Problem Analysis

Analyzing the issues with the Pangulu Nagori Amborokan Panei Raya Office's attendance system was the first step the author took in conducting this study. The Pangulu Nagori Amborokan Panei Raya Office still uses the manual approach for tracking employee attendance. An attendance book is used to track employee attendance. When using this strategy, several challenges and issues remain, such as the time and effort required to complete the attendance process, the difficulty of accessing employee attendance data, and the challenge of tracking and recapitulating employee attendance.

System Requirements Analysis

The writers come up with a remedy to the issue based on the outcomes of the system analysis that has been carried out. The author created an Android-based employee attendance application that can assist Pangulu Nagori Amborokan Panei Raya Office staff members in taking attendance as well as the Pangulu Nagori Amborokan Panei Raya Office administrator in quickly and easily monitoring and processing employee attendance data.

Planning

At this point, the author decides what is required for performing research, including the location, the time, the equipment, and the materials
Research Sites

In carrying out this research activity, the authors determine the location and time of the research. The location specified by the author in this study is the Pangulu Nagori Amborokan Panei Raya Office which is located at Jalan Besar Panei Raya, Kec. Raya Kahean, Kab. Simalungun North Sumatra 21156.

Research Tools

The hardware used in this study included an ASUS Zenfone Android smartphone, an Acer Aspire E5-471G-5251 laptop with an Intel Core i5-4210U processor, NVIDIA GeForce 820M 2GB GPU, and 4GB DDR3 RAM. Max Pro 1 with GPU AdrenoTM 509, 6GB RAM, and 16GB memory and Qualcomm Technologies, Inc. specifications. SDM636. The author also uses software such as Windows 10 Pro, Microsoft Word 2019, Kodular framework, Airtable database, Microsoft Visio 2019, Google Chrome browser, and the Android 9.1 Pie operating system.

Research Materials

Materials needed by the author in research activities consist of employee data at the Pangulu Nagori Amborokan Panei Raya Office, attendance data, attendance reports, and attendance procedures.

Analysis Risk

The authors conduct a risk analysis of the intended use of the application at this point. Before performing a risk analysis, the author evaluates the functional specifications needed to build an application. The following menus in Table 1 will be created by the author.

Table 1. Functional needs

Requirement Name	Description
Login	The page that loads first when you access the program
Options Menu	After the user logs in, a page with many options displays.
Employee Menu	Data processing page for employees
Attendance Menu	A page for employee attendance
Report Menu	Page to view employee attendance reports

Engineering

A developed concept makes it simple to articulate what must be done. The design focuses on the process of creating detailed specifications for the project's architecture, aesthetics, material requirements, and style [10]. A technique or model called UML is used to design object-oriented software development. Additionally, UML offers a standard for creating blueprint systems, which covers business process ideas, creating classes in certain programming languages, database schemas, and software system components [11].

Use Case Diagram

Use case diagrams describe typical interactions between users (users) of one system and a different system by telling a narrative about how the system is utilized. In use case diagrams, an actor and the interactions he engages in are shown. These actors might be people, objects, other systems, or other systems that engage in interaction with the system [12].
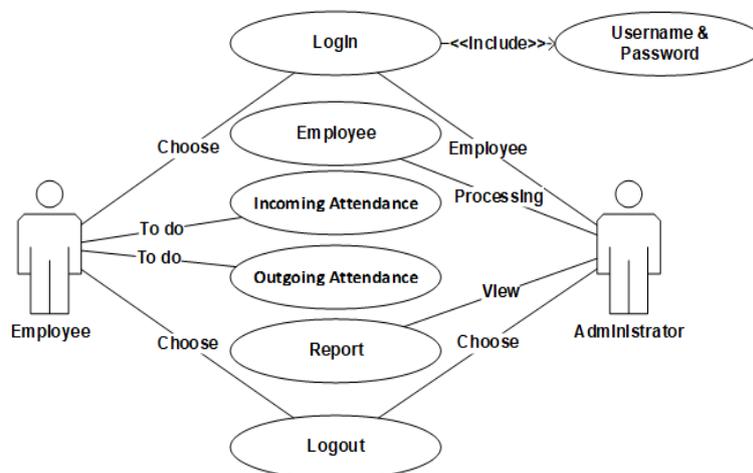

Figure 2. Use case diagram

Figure 2 illustrates the use case diagram of the application to be built. Use case diagrams to describe what actors can do in the application to be built. Android-based employee attendance applications can be accessed by two different types of users, namely administrators, and employees. Administrators can log in to the application by entering the specified username and password. Admins can perform data processing, and employee accounts can access the application. In addition, the administrator can also see reports of employee attendance data that have been processed. Employees can log in to the application by entering the username and password registered by the administrator. Employees can process attendance in or out after successfully logging in.

Sequence Diagram

A sequence diagram is a diagram that shows how various items work together dynamically. Its purpose is to display the exchange of messages between objects and their interactions [13].
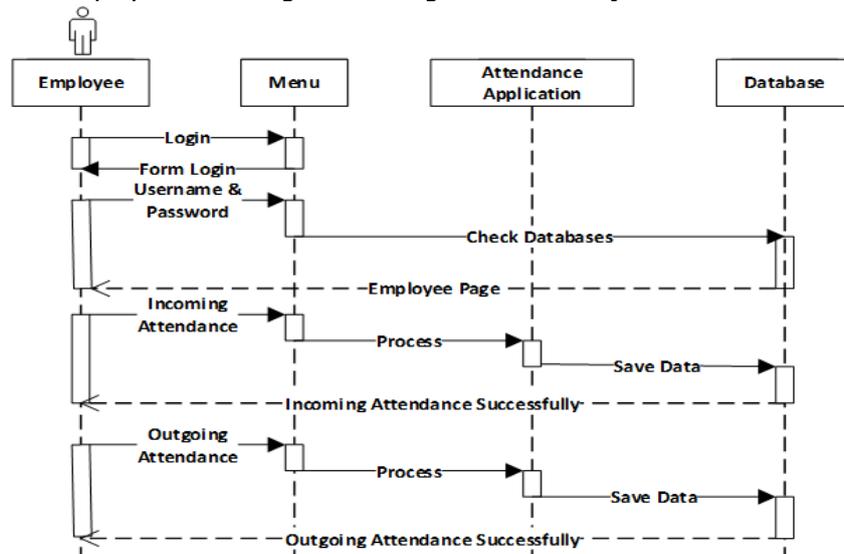

Figure 3. Sequence diagram

Figure 3 illustrates the sequence diagram of the application to be built. The sequence diagram of the Android-based employee attendance application that will be built begins when the admin logs in to the application. When the employee enters the username and password used by the login process, the system will check the username and password data in the database. Then the employee will enter the attendance page and select from the available menu consisting of incoming and outgoing attendance. When an employee selects one of the available attendance menus, the system will store the attendance data in the database.

Activity Diagram

Activity diagrams in software explain the workflow, activity, or business process of a system, business process, or menu. Instead of focusing on what actors perform, activity diagrams place more emphasis on describing system activities or activities that the system is capable of carrying out [14].
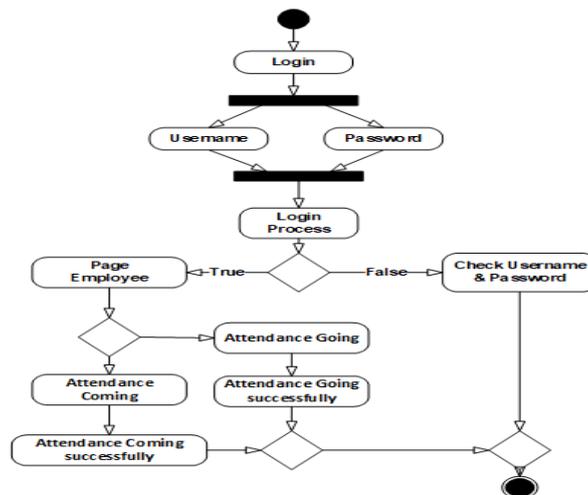

Figure 4. Activity diagram

Figure 4 illustrates the activity diagram. The activity diagram of the employee attendance application that will be built starts when the employee logs in to the application by entering the

specified username and password. Then the application verifies the username and password entered by the employee; if the username and password are correct, then the employee can enter the attendance page and select an option from the available attendance menu. If the username and password are incorrect, the employee cannot enter the application and must re-check the username and password entered. Employees can mark themselves as present or absent while in the attendance window. If the employee chooses to enter attendance, then the attendance data will be stored in the database. Similarly, if an employee chooses to leave attendance, the incoming attendance data will be saved in the database as well.

Class Diagram

A class diagram is a grouping of various classes and their connections. Classes are identical to entities expressed in a square with the name of the class written at the top, followed by a list of the class's characteristics and finally a list of its methods [15]. The class diagram is the foundation of object-oriented development and design because it is a specification that, when instantiated, creates an object [16].
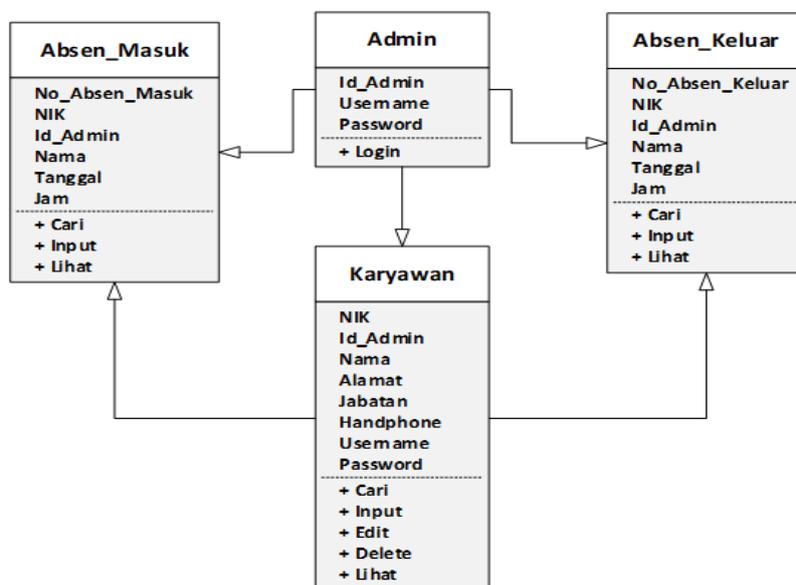
Figure 5. Class diagram

Figure 5 illustrates the class diagram or the relationship between each table in the application. Classes or tables in the employee attendance application at the Pangulu Nagori Amborakan Panei Raya Office consist of admin tables, employee tables, incoming attendance tables, and outgoing attendance tables. The admin table consists of id_admin, username, and password, the employee table consists of NIK, id_admin, name, address, position, mobile phone, username, and password, the incoming attendance table consists of No_attendance_in, NIK, Id_admin, name, date, time and outgoing attendance table consists of No_attendance_out, NIK, Id_admin, name, date, time.

Construction & Release

The implementation of software development is done at this point. The following display is the page for the employee attendance application. A page for logging in, a page for the options menu, a page for employees, a page for incoming and outgoing attendance, and a page for reports.

Login Page

The login page is the initial page that appears when the user uses the employee attendance application that was built. To provide security for using the application, before the user can access and use the application, on this page the user must first log in by entering the registered username and password. The login page display can be seen in Figure 6.

Figure 6. Login page

Attendance Page

After the employee has successfully logged in, he or she will go to the attendance page. On this page, employee data that has been processed by the administrator will automatically appear, consisting of NIK, Name, and Position, while the time for attendance has been adjusted to the current time. On this page, employees can check in and out of attendance. After the employee selects one type of attendance, a notification will appear explaining that the attendance process has been successfully carried out. The attendance page display can be seen in Figure 7.

Figure 7. Attendance page

Options Menu Page

Administrators can choose from the menu available on this page after successfully logging in using the appropriate username and password. There are three menus available, the employee menu, the report menu, and the logout menu. On the employee menu, administrators can perform employee data processing and determine accounts for employee logins. On the report menu, administrators can view employee attendance reports that have been processed. Meanwhile, on

the logout menu, the administrator can exit the options menu and return to the login page. The options menu page display can be seen in Figure 8.

Figure 8. Options menu page

Employee Page

After the administrator has successfully logged in, he or she can process employee data through the employee menu that has been selected. Administrators can get new employee infor-mation, consisting of NIK, name, address, position, and cellphone, and enter employee account data to carry out the login process, consisting of a username and password. In addition, admin-istrators can also change employee data that has been previously selected on the view page if an error occurs. Administrators can delete employee data that has been sorted on the view page if the employee has resigned or is no longer in the Pangulu Nagori Amborokan Panei Raya Office. The employee page display can be seen in Figure 9.

Figure 9. Employee page

Report Page

On this page, administrators can view a recapitulation of employee attendance reports that have been processed. The report displayed is the result of a recapitulation of employee absences

every month. Reports will be displayed based on the month that has been selected by the administrator. The information displayed on the report consists of date, NIK, name, time of attendance in, and time of employee attendance out. The report page display can be seen in Figure 10.

Figure 10. Report page

Customer Evaluation

Activities are necessary to collect user or client feedback in response to the engineering stage evaluation of the software representation that has been produced as well as implementation during software installation during the development and release phases.

The author conducts testing for every component of the constructed application. Application testing with black boxes is the final test, comprising the user interface or external look of the program, process performance, input, process, and output generated by the application, and how to use application features in the user environment, followed by validation testing [17]. Table of test results can be seen in Table 2.

Table 2. Table of test results

Testing Module	Testing Procedure	Input	Output	Conclusion
Employee Login	- Open application - Entry username "007882" and password "123456" - Click login	Username "007882" and Password "123456"	Employees can enter the application and take attendance	Valid
Attendance	- Open application - Login - Choose click incoming attendance or outgoing attendance	Button incoming attendance or outgoing attendance	Employees successfully do attendance	Valid
Employee Data	- Open application - Login - Select the employee menu - Enter complete employee data - Click input	Complete employee data	Employee data added successfully	Valid

| Report	- Open application - Login - Select the report menu - Select month	Select month	Show employee attendance reports based on the selected month	Valid

In addition, the author also tests the application when it is applied to an Android smartphone. In this testing process, the authors tested the application from the display, process, and performance sides when it was installed on different Android smartphone devices. The classification of Android devices determined by the author in this test consists of the operating system and the Android smartphone brand used by the user, consisting of ten devices: two Android version 8 devices, two Android version 9 devices, two Android version 10 devices, two Android version 11 devices, and two Android version 12 devices. The results of testing the application implementation can be seen in Table 3.

Table 3. Table of testing the application on android devices

| Devices	Android Version	Information System Display	Information System Process	Information System Performance
Xiaomi Redmi 6A	Version 8	Success	Success	Success
Vivo Y71	Version 8	Success	Success	Success
Infinix Smart 3 Plus	Version 9	Success	Success	Success
Realme 3 Pro	Version 9	Success	Success	Success
Vivo X27	Version 10	Success	Success	Success
Xiaomi Mi 8 Pro	Version 10	Success	Success	Success
Oppo Reno 5 4G	Version 11	Success	Success	Success
Vivo V20	Version 11	Success	Success	Success
Oppo Find X3 Pro	Version 12	Success	Success	Success
Vivo V60 Pro	Version 12	Success	Success	Success

After testing, the author creates a questionnaire to obtain evaluation results from the use of the application that has been built. The questionnaire was administered to ten employees of the Pangulu Nagori Amborokan Panei Raya Office. The questionnaire instrument created relates to the ease of using the application, the appearance of the application, and the performance of the application in helping to facilitate the employee attendance process at the Pangulu Nagori Amborokan Panei Raya Office. Figure 11, Figure 12, and Figure 13 are the results of the questionnaire.

Kemudahan menggunakan aplikasi
10 jawaban

Sangat Baik (Very Good)
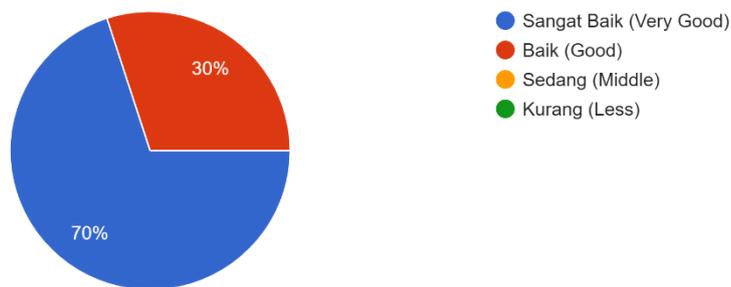Baik (Good)
Sedang (Middle)
Kurang (Less)
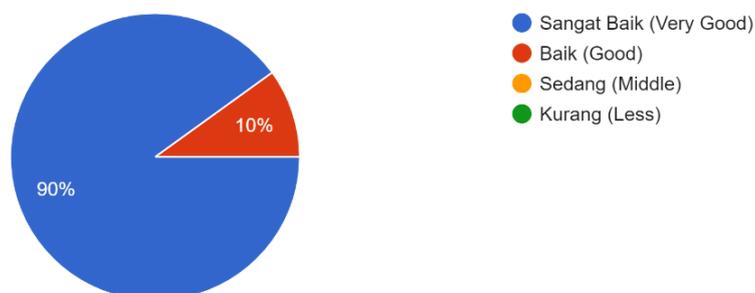
Figure 11. Application usage survey results

Tampilan menarik dan mudah dimengerti
10 jawaban
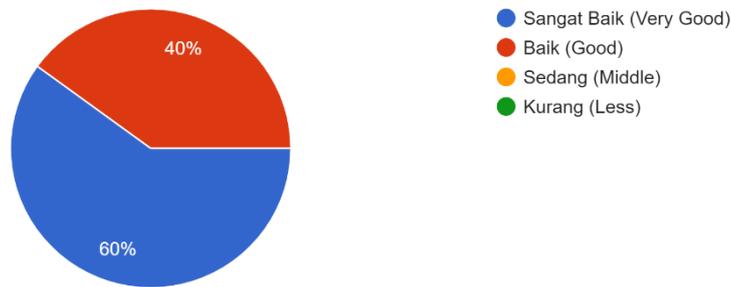
Figure 12. Application design survey results

Aplikasi membantu mempermudah proses absensi
10 jawaban

Figure 13. Application benefits survey results

Conclusion

In order to create applications that meet user needs, the spiral model system development method used in this study has structured and complex stages for carrying out system development, including customer communication, planning, risk analysis, engineering, construction, and release, as well as customer evaluation. Based on the results of a survey conducted by the author regarding applications that have been built based on the ease of use of the application, the appearance of the application is attractive and easy to understand, and the benefits of the application assist in carrying out employee attendance, Of the ten employees of the Pangulu Nagori Amborokan Panei Raya Office who filled out the questionnaire form, 90% of respondents answered very well for the ease of use of the application, and 10% of respondents answered well for the ease of use of the application. 60% of respondents answered very well regarding the appearance of the application, and 40% of respondents answered well regarding the appearance of the application. 70% of respondents answered very well about the benefits of the application in facilitating the attendance process, and 30% of respondents answered well about the benefits of the application in facilitating the attendance process. So it can be concluded that 70% of respondents answered very well about the application that was built in terms of ease of use, appearance, and benefits to facilitate the attendance process so that the application can assist employees in carrying out attendance via Android smartphones, and administrators can use Android smartphones to track employee attendance in real-time. The Pangulu Nagori Amborokan Panei Raya Office currently uses a manual attendance system that can be replaced with an Android-based attendance application to become a technology-based attendance system by utilizing an Android smartphone.

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