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SI-MAMAS : Design and Development of a Mobile-Based Mosque Management Information System

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***Abstract*— The Nurul Huda Mosque is one of the mosques in the city of Medan. So far, the Nurul Huda Mosque has not provided a facility or media that can be used to manage data, such as management data, financial data, activity data, and inventory data. The data management process is still carried out conventionally on a book, so several problems still occur, especially regarding data completeness, data damage, and loss of data that has been processed. The aim of this research is to build a mobile-based information system that can be used to manage mosque data. In building the information system, the author used the Rapid Application Development (RAD) method, which consists of planning stages, design workshops, and implementation. Meanwhile, the tool used by the author in creating information system designs visually is UML (Unified Modeling Language). The mobile-based information system was built using the Kodular framework and the Airtable database. With this information system, it is hoped that it can help the Nurul Huda Mosque process data easily and quickly via an Android smartphone.**

***Index Terms*— *Android; Management; Mosque; Mobile; Information Systems*.**

I. INTRODUCTION

The modern era we are currently living in has witnessed very rapid developments in several science and technology sectors. This progress directs how each person, community, group, or organization can deal with it. Effective management, or governance, is one way to overcome this. Effective organizational management can produce good and high-quality results. Therefore, this management is very important for any organization [1].

A mosque is a physical location and representation of Islam. Mosques play a very important role in the service of the people as a gathering place for religious activities, a place for studies of the Koran and Al-Hadith, and a cultural center for Muslims [2].

Poor management will prevent a mosque from operating at its highest potential, regardless of its complexity or simplicity. Because productive and effective administration is a must for every organization or institution, As a result, in a mosque, management must be the main focus. Increasing awareness of the purpose of all mosque management activities, namely, developing human resources for organizational success, is necessary to achieve this situation [3].

Nurul Huda Mosque is one of the mosques in Medan City, located at Jl. Marelan Raya, Tanah Enam Hundred, District. Medan Marelan, Medan City, North Sumatra 20244. So far, the Nurul Huda Mosque has not provided a facility or media that can be used to manage data, such as management data, financial data, activity data, and inventory data. The data management process is still carried out conventionally on a book, so several problems still occur, especially regarding data completeness, data damage, and loss of data that has been processed. Aside from that, the Nurul Huda Mosque also does not provide technology-based facilities for conveying information to the public. The process of conveying information still uses mosque loudspeakers, so that the process of conveying information and receiving information by the public becomes ineffective.

Similar research conducted by Budhy et al. in 2021 discussed the steps involved in developing a website-based mosque management information system using the PHP programming language and using the waterfall development method at the Baitul Ikhwan Mosque. Now it is easier for the public to find information about mosque management thanks to this website, and it also makes it easier for mosque managers to summarize data by printing it in softcopy in PDF format because it will be easier to search for files in the system and print them [4].

Similar research was conducted by Yanni Suherman and Erien Nada Azandra in 2021, discussing that managers of the Sungai Limau Grand Mosque often have difficulty managing data due to the large number of mosque operations. A waterfall system development approach is used to create a system that will really help administrators process data related to mosque management. This system utilizes a web-based application program for program planning and report preparation [5].

Similar research was conducted by Wagino in 2020 discussing the Sabilal Muhtadin Grand Mosque, Banjarmasin, which had created a Management Information System to computerize the management of the Banjarmasin Sabilal Mosque management body, which is currently still manual in its management. This information system was created with the help of Microsoft Access 2013 and Borland Delphi 7.0 software. The management of the Sabilal Muhtadin Banjarmasin Mosque considers this information system to be very useful, for example, controlling the use of the computerized multi-purpose hall and archiving data on mosque management, cash in and cash out data, data on lecturers, data on kiai and Friday prayer speakers, as well as data on the imam who leads obligatory prayer [6].

The authors' research differs from previous research in several important ways. The author conducted research aimed at building a mobile-based information system that can be utilized by Nurul Huda Mosque administrators in managing mosque data, including financial data and inventory data, and can also be used as a medium for conveying information to the public.

II. METHODOLOGY

A. System Development Method

Rapid Application Development (RAD) is the information system development approach used in this research. The three key phases of this methodology are planning, RAD design, and implementation. Speed in the development process is also prioritized with the RAD development method. where the development process can be completed quickly [7]. The RAD model can be seen in Figure 1.

Fig.1. RAD Method Stages

The stages contained in RAD can be explained as follows [8]:

1. Analysis of problems and identification of needs for the information system to be built. Actions taken include:
   - Identifying what happened at the Nurul Huda Mosque related to the process of processing financial data, inventory, and conveying information.
   - Identify functional requirements and information needs.
   - Presents alternatives to the suggested system. This section lists any requirements for software, hardware, and human resources.
   - System selection and continuity. choosing one of several alternative system solutions available.
   - Object modeling. In this section, we will model the system using objects and related classes.
2. RAD Design Workshop: At this point, the author explains about creating an information system. Modeling the information system to be created is the current process step. UML (Unified Modeling Language), which includes use case diagrams, sequence diagrams, activity diagrams, and class diagrams, is used to model this system. In this step, the new system design is written and described, and the following tasks are completed:
   - Combines diagrams with features that allow the creation of models, outputs, processes, and transactions using specific symbols.
   - Designing database and table requirements
   - Display interface class design.
3. Implementation, which involves converting all previously completed work into an information system that utilizes the Kodular framework and Airtable database.

B. Method of Collecting Data

Data collection procedures are the fundamental methods used in a study to gather data, which is the primary objective of the investigation. The author employs methodologies for data collection in conjunction with the system development approach. In the absence of familiarity with the methodologies, researchers will be unable to gather data that adheres to pre-established criteria [9].

The author collected the necessary data for this research activity using the following method:

1. Observation

Data collection occurs through direct observation and recording of research objects. At this stage, the researcher recorded matters relating to the process of processing financial data, inventory, and information at the Nurul Huda Mosque.

2. Interview

Gathering information through direct conversations with the chairman of the Nurul Huda Mosque management and the community. Here, researchers ask questions related to the process of processing financial data, inventory, and conveying information.

3. Literature review

To search for ideas or concepts that might serve as a basis for a theory or research framework, to identify the best research procedures, and to contrast current theory with empirical data.

III. RESULTS AND DISCUSSION

A. Analysis of Problem and Identification

1. Analysis of Problems

Before carrying out the design stage, the author first analyzes the problems in the running system. The analysis carried out by the author focuses on the financial processing process, the mosque inventory processing process, and the process of conveying information to the public. Based on the results of the author's observations at the Nurul Huda Mosque and the results of the author's interviews with the chairman, treasurer, facilities infrastructure department and the public, the financial processing and inventory process of the mosque is still carried out manually, namely recorded in books, while the process of conveying information to the public is still carried out using loudspeakers or mosque toa. Based on this process, there are still several problems or obstacles that occur, including:

- The mosque still processes its finances and inventory by hand. So it requires a lot of time, money, and energy.
- Difficulty searching for data.
- Data damage and loss occur.
- Loudspeakers or mosque toa do not provide clear communication.
- The scope of information delivery is limited.

2. Identify System Requirements

After conducting a thorough analysis of the current system, the author suggests a solution to address this issue. The proposal involves creating an Android-based mosquito management information system. This system will aid Nurul Huda Mosque administrators in managing financial data, inventory data, and other related processes. The solution will expedite the efficient distribution of information to the general population using Android smartphones. The author employed the following strategy to gather the necessary data for this research endeavor:

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B. RAD Design Workshop

The information system design process that will be built uses the Unified Modeling Language (UML) model, which consists of use case diagrams, sequence diagrams, activity diagrams, and class diagrams.

1. Use Case Diagram

A use-case diagram is a graphical representation that depicts the standard interactions between system users and the system itself by narrating the system's usage story. A use-case diagram comprises an actor and the interactions they execute. The system's actors can include humans, hardware, other systems, or other entities that interact with the system. The author proposes a solution to address this issue based on the findings of the ongoing system analysis. The proposal involves creating an Android-based mosquito management information system. This system will aid Nurul Huda Mosque administrators in managing financial data, inventory data, and other related tasks. The solution will expedite the efficient distribution of information to the general population using Android smartphones. Meanwhile, the author used the following strategy to collect the necessary data for this study [10].

The Mosque Management information system was built on a multiuser basis so that it can be accessed by different users, namely the head of the management. Treasurer, facilities and infrastructure sector, public relations, and community sector. The use case diagram of the mosque management information system to be built can be seen in Figure 2.

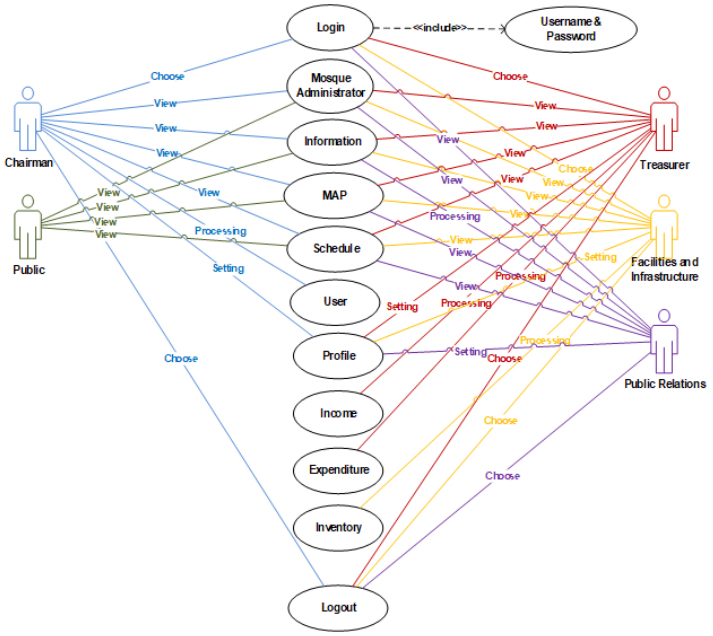

Fig.2. Use Case Diagram

Figure 2 presents the use case diagram for the upcoming information system. Use case diagrams depict the actions that actors can perform within the information system under development. The mobile-based mosque management information system is accessible to the chairman of the management, treasurer, and the facilities and infrastructure department. Section on Humanity and Society. Prior to accessing the information system, every user is required to log in by providing a user name and password and selecting pre-established access privileges. The chairman holds the authority to manage user data, the treasurer oversees income and expenditure data, the facilities and infrastructure department manages mosque inventory data, the public relations department manages mosque activity schedules and disseminates information to the public, and the public has the ability to access and view the managed information. The public relations department of the mosque issues these schedules.

2. Sequence Diagram

Sequence diagrams depict the exchanges and communications that occur among items. Sequence diagrams provide a detailed description of the actions and interactions that occur in a particular event. A use-case diagram illustrates a set of sample objects and the messages that are sent between them [11]. Illustrates the sequential or chronological interactions among items within the system, such as users, displays, and others, through the exchange of messages [12].

Sequence diagrams are divided into chairman sequence diagrams, treasurer sequence diagrams, infrastructure sector sequence diagrams, and public relations sequence diagrams. The treasurer's sequence diagram This sequence diagram illustrates the interaction between the treasurer and the information system in order to acquire the necessary information. Figure 3 displays the Treasurer's Sequence Diagram. The sequence diagram of the mosque management information system to be built can be seen in Figure 3

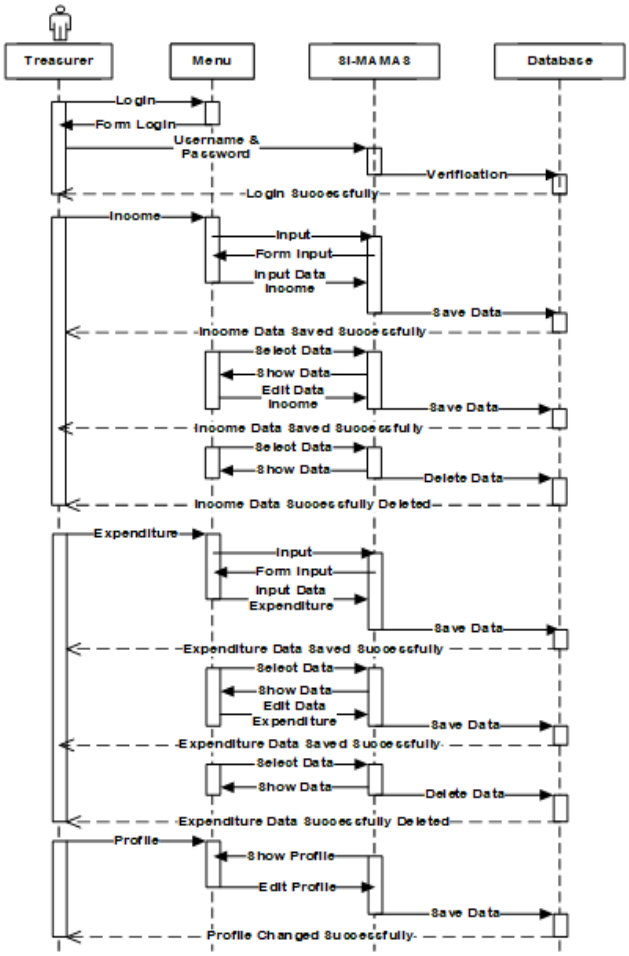

Fig.3. Use Case Diagram

Figure 3 depicts the sequence diagram of the information system under construction. The sequence diagram for the forthcoming mobile-based mosque management information system begins with the treasurer's authentication into the system. When the username and password are entered during the login procedure, the system will verify the credentials against the database. Next, the treasurer will navigate to their designated page. When the treasurer selects the income or expenditure menu, they can input, edit, or

delete the income or spending data. The treasurer has the ability to enter revenue or spending data into the information system using the provided form, and then store the data in the database. Within the edit feature, the treasurer has the ability to choose either revenue or spending data and modify the selected data before saving it. In the delete option, the treasurer has the ability to select and erase specific income or spending data from the database. The profile menu allows the treasurer to access and manage their profile data.

Activity diagrams depict the sequence of activities within a planned system, beginning with its initiation and encompassing the decision-making process until its completion. Activity diagrams can also represent concurrent processes that take place during several executions. [13]. The activity diagram of the mosque management information system to be built can be seen in Figure 4.

3. Activity Diagram

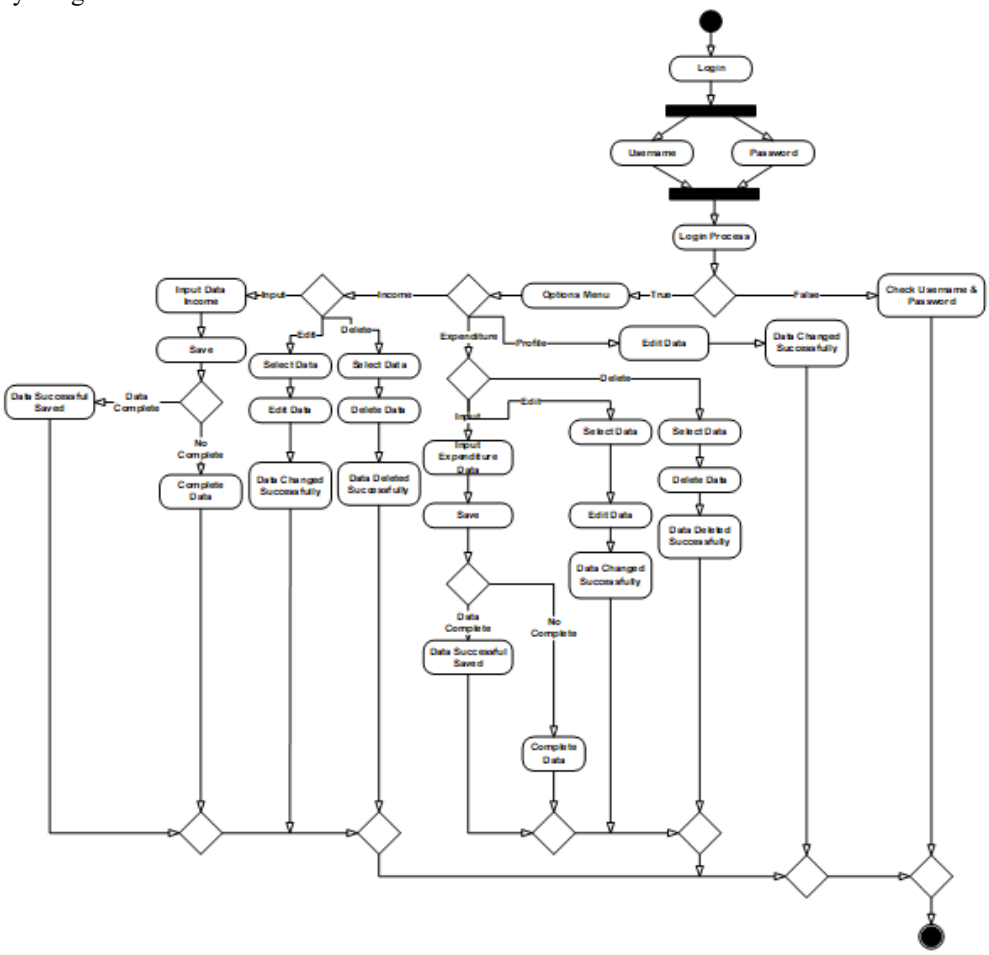

Fig.4. Activity Diagram

Figure 4 illustrates the activity diagram. The activity diagram for the forthcoming mobile-based mosque management information system begins with the treasurer's login to the system, which is completed by inputting the designated username and password. Subsequently, the information system authenticates the username and password provided by the treasurer. Provided that the username and password are accurate, the treasurer is able to access the choices menu page and choose from the available menu items. If the login and password provided are incorrect, the treasurer will be unable to access the information system and will need to verify the authenticity of the submitted username and password. Within this information system, the treasurer has the ability to choose from multiple menu selections. The treasurer will receive input choices to update or delete income or spending data in the information system upon selecting the revenue or expenditure menu. The input option in the information system verifies the integrity of the revenue or spending data entered by the treasurer. The database can process and store comprehensive data. However, we cannot process incomplete revenue or spending data. In such cases, the treasurer must first fill in the data. Previously. Within the edit and delete choices, the information system will securely store the modifications made by the treasurer to the revenue or spending data. After selecting the profile menu, the treasurer can access and manage their profile data.

4. Class Diagram

A class diagram is used to visualize the system structure by defining the classes that build it. Classes have properties, methods, and operations that are called [14].

Classes or tables in the mosque management information system consist of user tables, income tables, expenditure tables, inventory tables, and information tables. The class diagram can be seen in Figure 5.

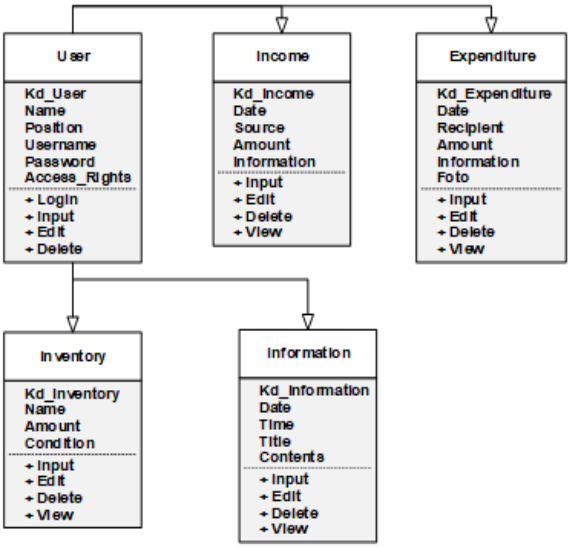

Fig.5. Class Diagram

Figure 5 illustrates the correlation between each table in the mobile-based mosque management information system. The structure of the user table includes the following columns: kd_user, name, position, username, password, and access rights. Five columns make up the income table: kd_income, date, source, amount, and information. The structure of the expenditure table includes the following columns: kd_expenditure, date, recipient, amount, and photo. The structure of the inventory database includes the following columns: kd_inventory, name, amount, and condition. The structure of the information table has the following columns: kd_information, date, time, title, and contents. The chairman has the authority to handle user data; the treasurer is responsible for managing income and spending data; the facilities and infrastructure department is in charge of processing inventory data; and the public relations department is responsible for managing information and schedules related to mosque activities.

5. Entity Relationship Diagram (ERD)

Entity Relationship Diagram (ERD) for modeling file structure is a software system object which is the elements of the designed software system, one of these objects is data. Data are raw facts, which must be documented by the system to create information [15]. An ERD image of the mosque management information system to be built can be seen in the picture 6.

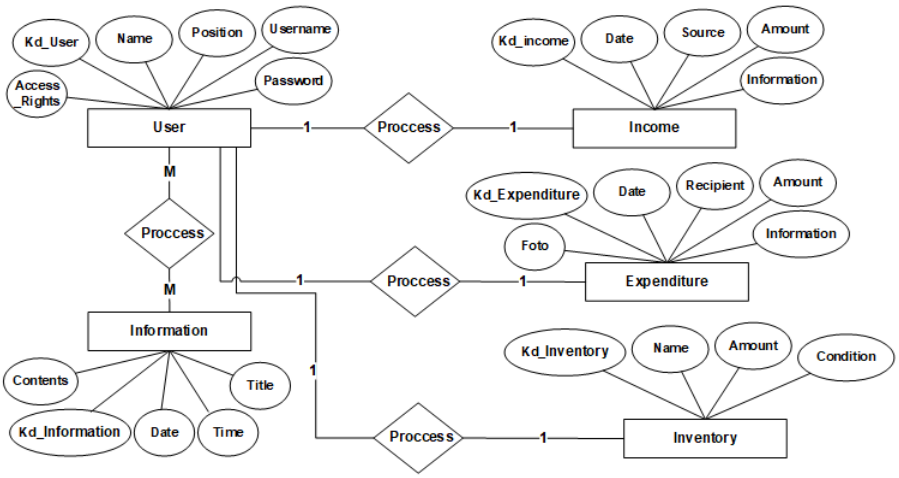

Fig.6. Entity Relationship Diagram (ERD)

Figure 6 is an entity relationship diagram (ERD) model which describes the structure of the management information system to be built. Management information systems consist of four main elements, namely users, income, expenditure, inventory, and information. Each element has its own attributes and interacts with one another. There are five different types of users, namely chairman, treasurer, facilities and infrastructure, public relations and public. Each can carry out different data processing processes. The treasurer can process income and expenditure data, the facilities and infrastructure sector can process inventory data, the public relations sector can process information and schedules. The chairman can monitor and see all data that has been processed by each section and all users can see information that has been processed by the public relations sector.

D. Implementation

1. Impelementation Information System

The page display of the information system built consists of the login page display, user data page display, inventory data page display, income data page display, expenditure data page display, financial report page display, and inventory report page display.

- Login Page Display

  Prior to accessing the information system, the user is required to log in by providing the designated username and password. Figure 7 depicts the visual representation of the page layout.

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Fig.7. Login Page Display

- User Data Page Display

  On this page, the chairman can process user data. Figure 8 illustrates the page display.

Fig.8. User Data Page Display

- Inventory Data Page Display

  On this page, the infrastructure department can process mosque inventory data. Figure 9 illustrates the page display.

Fig.8. Inventory Data Page Display

- Display the Income Data Page
  On this page, the treasurer can carry out the processing of cash inflows. The page display can be seen in Figure 10.

Fig.10. Display of the Income Data Page

- Expenditure Data Page Display\
  On this page, the treasurer can carry out the processing of money disbursement. Figure 11 illustrates the page display.

Fig.11. Expenditure Data Page Display

- Financial Report Page Display
  Users can view processed financial reports by month on this page. Income and expenditure reports. Figure 12 illustrates the page display.

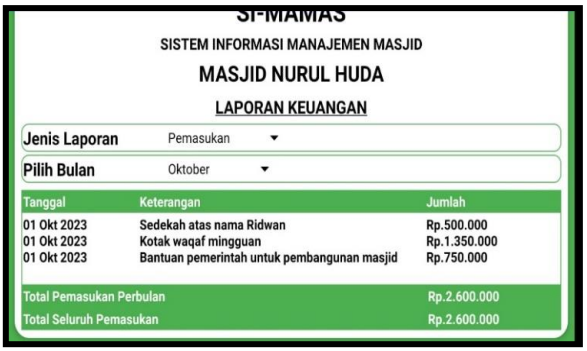

Fig.12. Financial Report Page Display

2. Information System Testing

We conduct information system testing to assess the program's functionality and identify any errors or issues. We tested this research using the black box method. Black box testing is a type of testing that focuses specifically on an information system's requirements [16], including user interface, performance, input, processing, and output. It also examines how information system features are used in the user's environment. This type of testing is followed by validation testing [17]. The black box testing results are shown in Table I.

TABLE I. TABLE STYLES

Testing Module	Testing Procedures	Input	Output	Conclusion
Login Page	-Run the Information System -Select the Login Menu -Enter the username "hanafi" and password "123456 -Select “Chairman” access rights -Click Login	Username "hanafi" and password "123456"	The chairman can enter the information system and select the available menu	Valid
User Data Page	-Run the Information System -Login -Select the user data menu -Enter complete user data -Click input	Complete user data	User data added successfully	Valid
Inventory Data Page	-Run the Information System -Login -Select the inventory data menu -Enter complete inventory data -Click input	Complete inventory data	Inventory data added successfully	Valid
Income Data Page	-Run the Information System -Login -Select the input data menu -Enter complete income data -Click input	Complete income data	Income data added successfully	Valid
Expenditure Data Page	-Run the Information System -Login -Select the expenditure data menu -Enter complete expenditure data -Click input	Complete expenditure data	Expenditure data added successfully	Valid
Information Page	-Run the Information System -Login -Select the information menu -Enter complete information -Click input	Complete information	Information added successfully	Valid

Furthermore, the information system undergoes testing on Android smartphones to evaluate its appearance, functionality, and efficiency when installed on various Android smartphone models. The Android device classification in this test is based on the user's operating system and brand of Android smartphone. It includes ten devices: three running Android version 10, three running Android version 11, three running Android version 12, and three running Android version 13. The outcomes of the testing conducted for the implementation of the information system are presented in Table II.

TABLE II. TABLE OF TESTING THE INFORMATION SYSTEM ANDROID DEVICE

Devices	Android Version	Information System Display	Information System Process	Information System Performance
Xiaomi Mi A2	Version 10	Successful	Successful	Successful
Realme X2 Pro	Version 10	Successful	Successful	Successful
vivo V15 Pro	Version 10	Successful	Successful	Successful
Samsung Galaxy S10	Version 11	Successful	Successful	Successful
Realme 6 Pro	Version 11	Successful	Successful	Successful
Vivo V17 Pro	Version 11	Successful	Successful	Successful
Xiaomi Mi 11X Pro	Version 12	Successful	Successful	Successful
Oppo Find X3 Pro 5G	Version 12	Successful	Successful	Successful
Realmi 8i	Version 12	Successful	Successful	Successful
Xiaomi 12S Pro	Version 13	Successful	Successful	Successful
Vivo X80 Pro	Version 13	Successful	Successful	Successful
Realmi 9i	Version 13	Successful	Successful	Successful

IV. CONCLUSIONS

After conducting this research, the author draws conclusions from the research that has been carried out regarding the design and development of a mobile-based Nurul Huda Mosque management information system, namely: The information system built can help the chairman of the Nurul Huda Mosque management see data reports that have been processed by the mosque management, such as financial reports and mosque inventory reports, the information system built can help the treasurer of the Nurul Huda Mosque to process financial data, consisting of income and expenditure, the information system built can help the facilities and infrastructure sector of the Nurul Huda Mosque to process mosque inventory data, the information system built can help the public relations sector of the Nurul Huda Mosque to convey information related to mosque activities or other information to the public, the developed information system facilitates public access to information disseminated by the administrators of Nurul Huda Mosque. An Android smartphone can access this technologically advanced data processing system, which replaces the mosque's manual data processing system. We specifically designed the information system to meet the specifications of Android smartphones commonly used by most individuals, ensuring a seamless installation and utilization experience. Android smartphones can access this technologically advanced data processing system, which replaces the mosque's manual data processing system. We specifically designed the information system to meet the specifications of Android smartphones commonly used by most individuals, ensuring a smooth installation and utilization experience. Based on the results of testing the use of a mobile-based mosque management information system that has been built by users including the chairman, treasurer, facilities and infrastructure, public relation and the public. Conclusions that can be drawn from before and after using the management information system by the user. The conclusion results can be seen in table III.

TABLE III. BEFORE AND AFTER USING THE APPLICATION

Indicator	Before using the app	After using the app
Financial data processing time	The processing time for financial data is longer because it is done manually by writing it in a book.	Financial data processing time is faster because it is done automatically by the information system.
Inventory data processing time	The inventory data processing time is longer because it is done manually by checking the inventory data one by one and then writing it in a book.	Inventory data processing time is faster because it is done automatically by the information system.
Time and scope of the process of conveying information to the public	The process of conveying information is longer, and the scope is limited.	The process of conveying information to the public becomes faster and the scope of information is wider because it uses an online-based information system
Time required for the creation of a report.	The report creation process takes longer because it is done manually by viewing and writing data one by one	The report creation process is faster because it is done automatically by the information system

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